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See Page 65

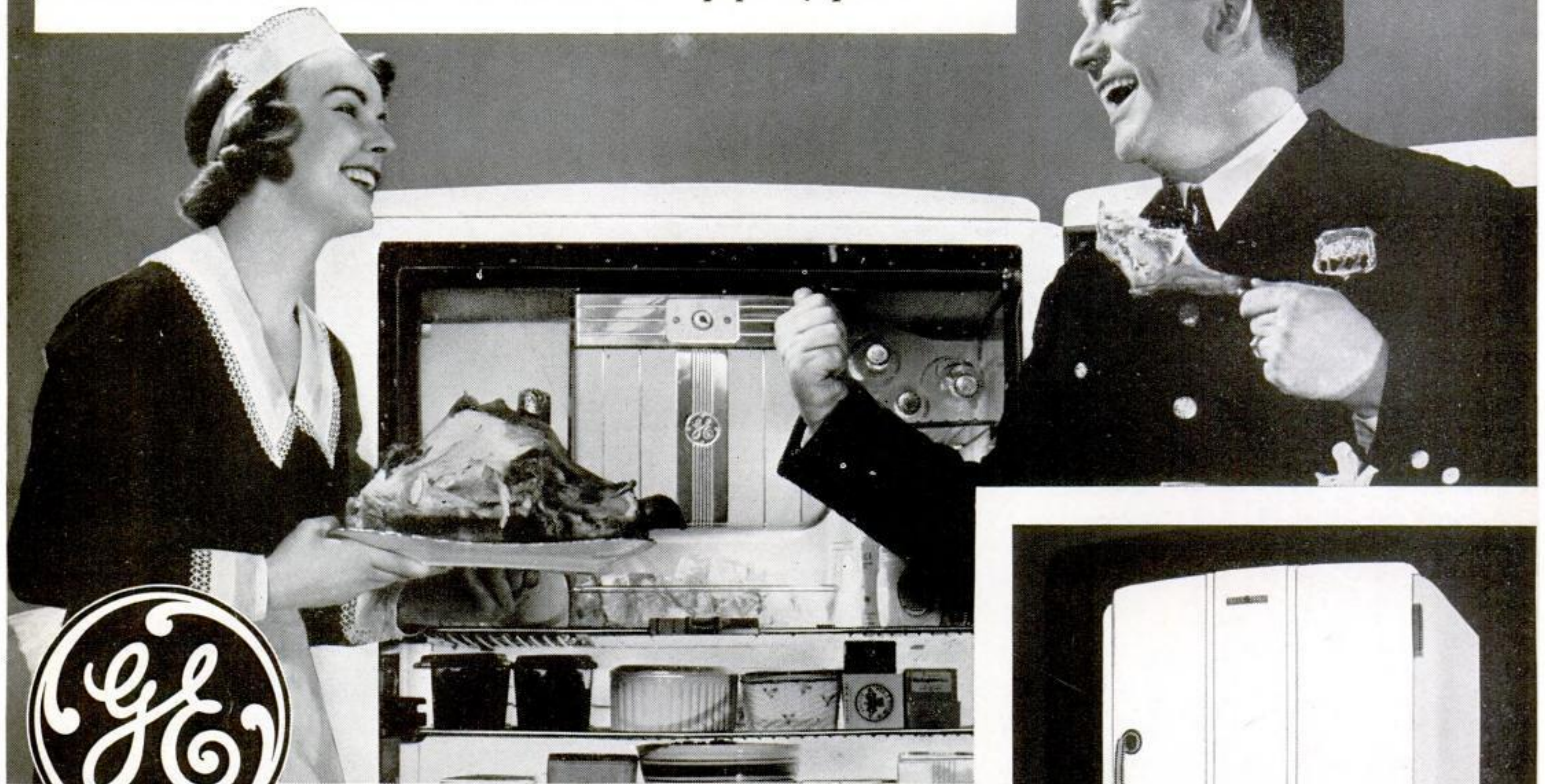
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# NOW! A Million More Homes Can Afford a Genuine G-E Refrigerator!

"THAT G-E'S THE KIND I'll be getting for *you* when we have our own little place. It's sure a swell looking job and has the famous General Electric sealed-in-steel Monitor Mechanism, too!" So little money buys so much General Electric Refrigerator this year that practically everybody can now afford one. This first choice of millions is now popularly priced!



## Triple-Thrift REFRIGERATOR

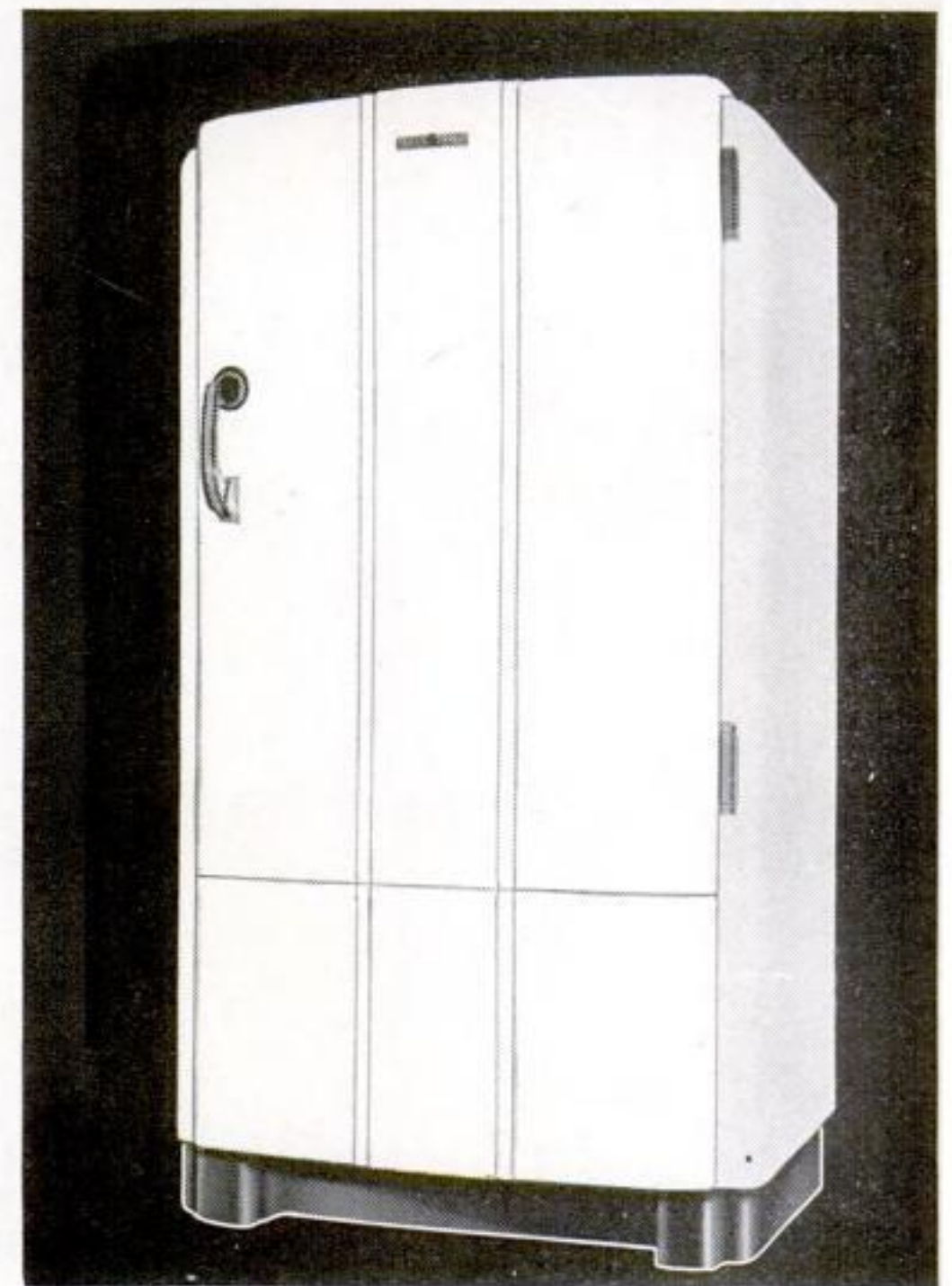


**OIL COOLING.** The simple sealed-in-steel G-E mechanism is permanently supplied with oil that is forced under pressure to all moving parts. The oil is then pumped to the outer casing and thus the generated heat is dissipated into the surrounding air. This General Electric feature means low current cost and long life.

**1 POPULARLY PRICED!** Never before so much General Electric Refrigerator value for your money.

**2 LOW CURRENT COST!** Famous sealed-in-steel G-E Thrift Unit now produces even more cold with less current than ever.

**3 LONG LIFE!** An unsurpassed record for *enduring* economy. Hermetically sealed mechanism carries 5 years performance protection, a plan originated by G-E.



**ALL-STEEL CABINETS.** Superbly styled cabinets are sturdy all-steel construction with one-piece porcelain interiors and latest convenience features. Super Freezer is stainless steel that cannot chip nor tarnish. The new G-E Quick Trays provide faster freezing and instant ice cube release. Two cubes or a trayful can be released in seconds.

GENERAL ELECTRIC CO., SPECIALTY APPLIANCE DIVISION, NELA PARK, CLEVELAND, O.

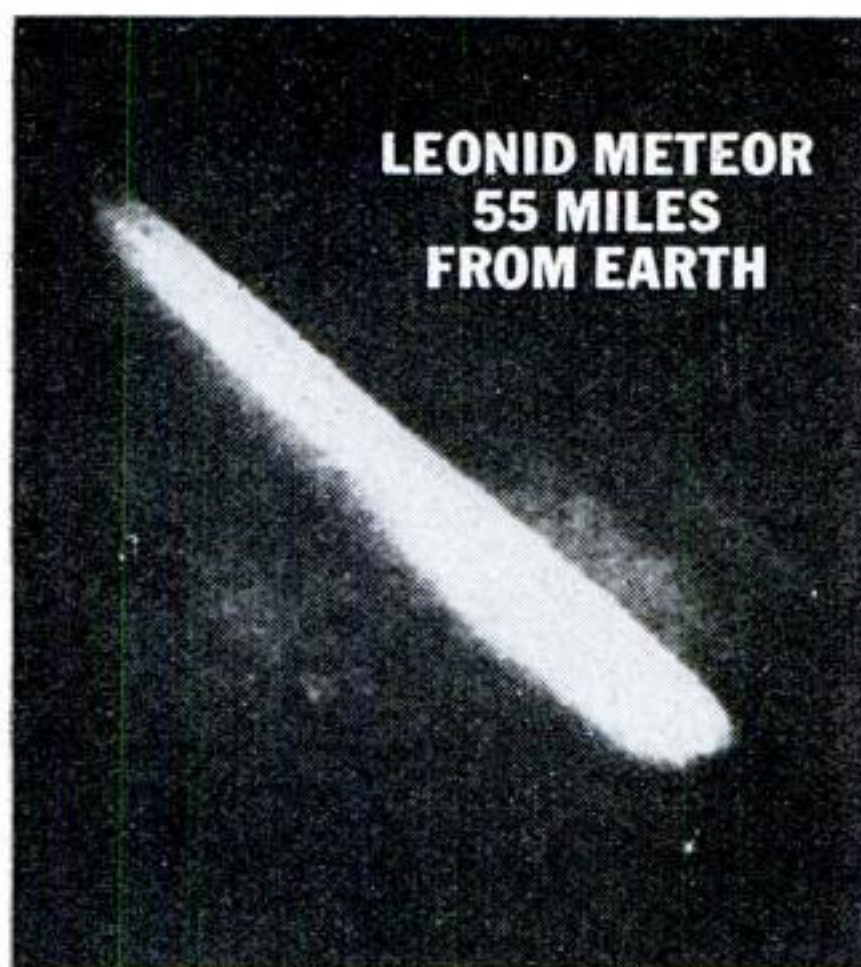
# GENERAL ELECTRIC

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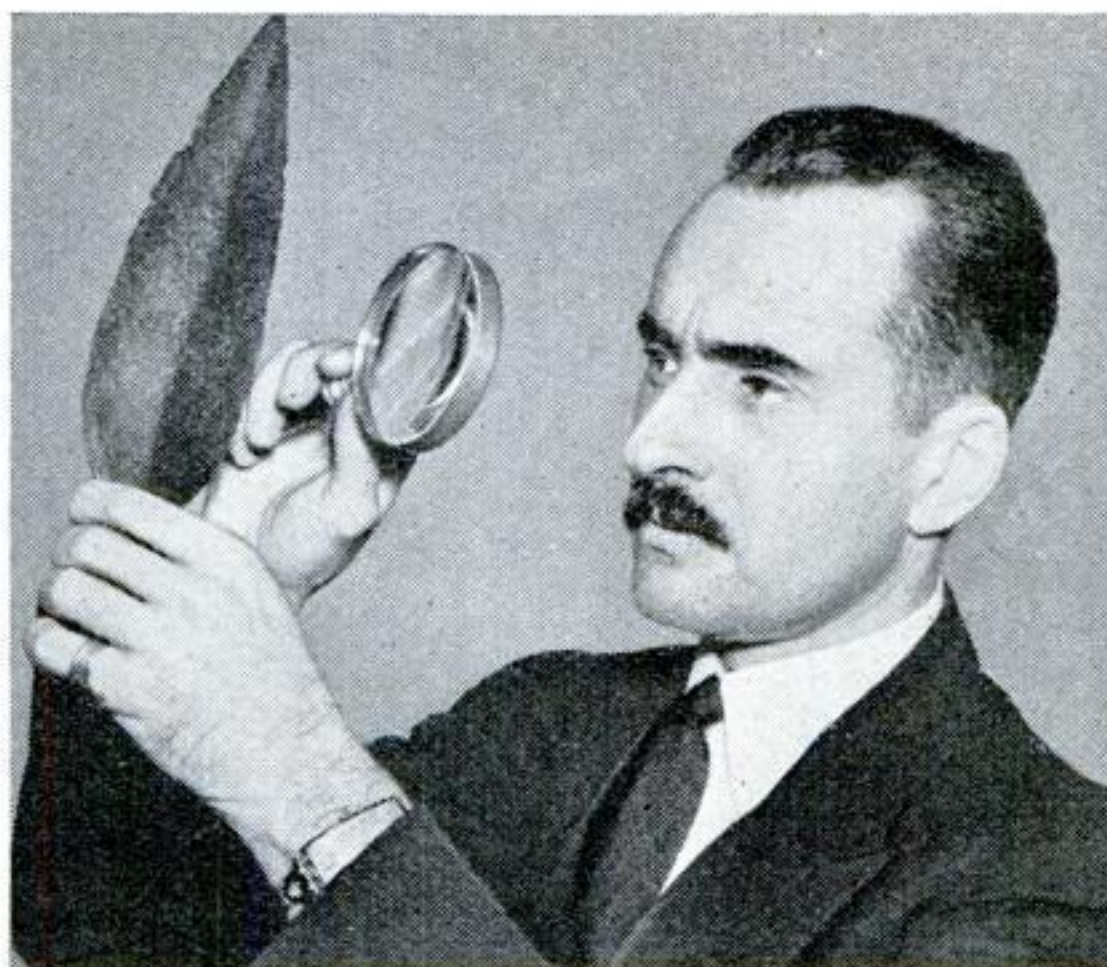
# Born in a Meteor's Burst...Story of Metal

THOUSANDS OF YEARS AGO, a savage found a fallen meteor—broke a piece from it—beat it into a crude spearhead. Thus began the Iron Age! Read how Plymouth treats metals today—to give you the brilliant performance and economy of "the car that stands up best!"



**LEONID METEOR**  
55 MILES  
FROM EARTH

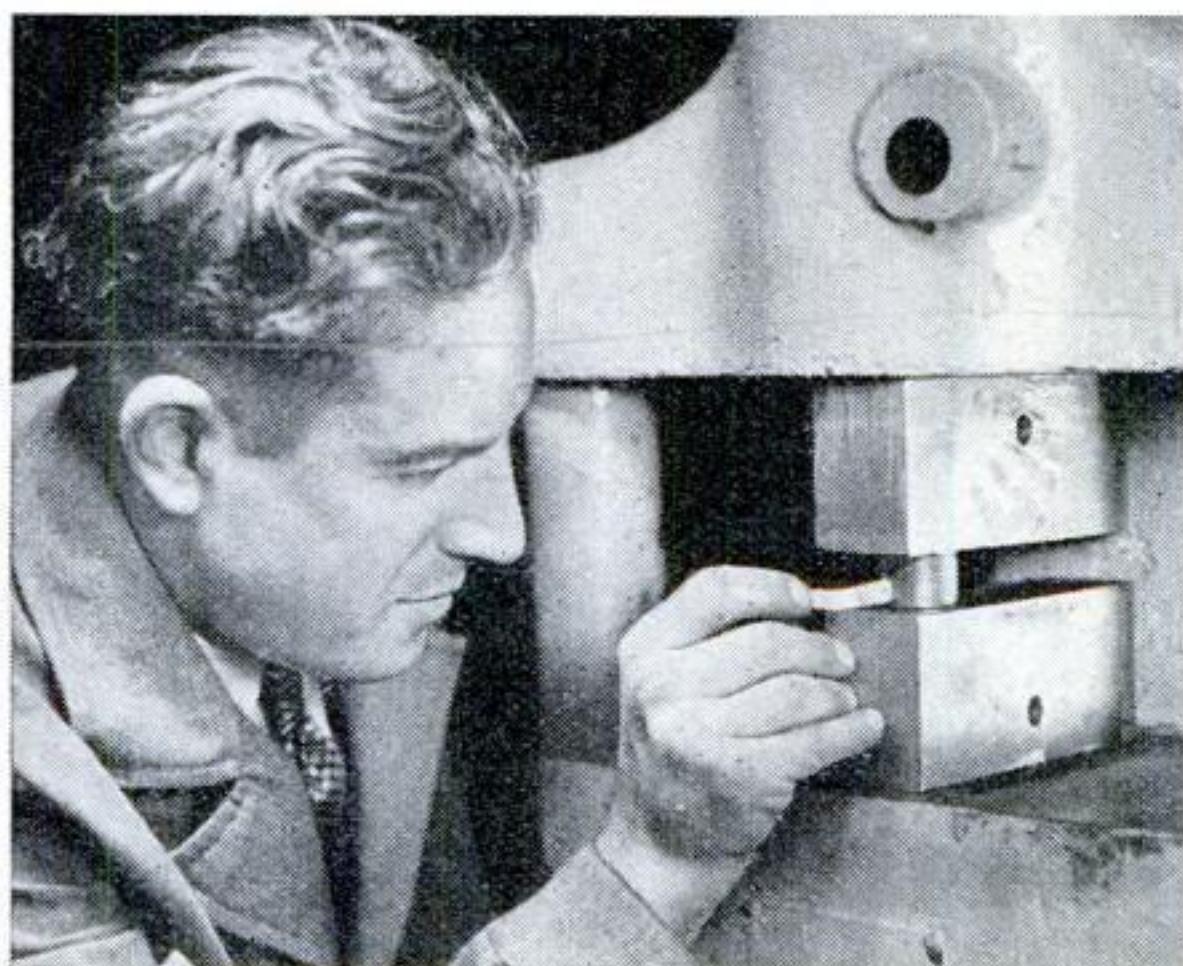
**1** **Meteors Carry metal ores!** Man's discovery of how to use metal was a big step forward. Read about the better metals that go into Plymouth!



**2** **4000-Year-Old Spearhead** found in Egypt. Today, Plymouth scientists produce special alloys just as precisely as a pharmacist mixes drugs. Example: Plymouth's super-hard pistons.



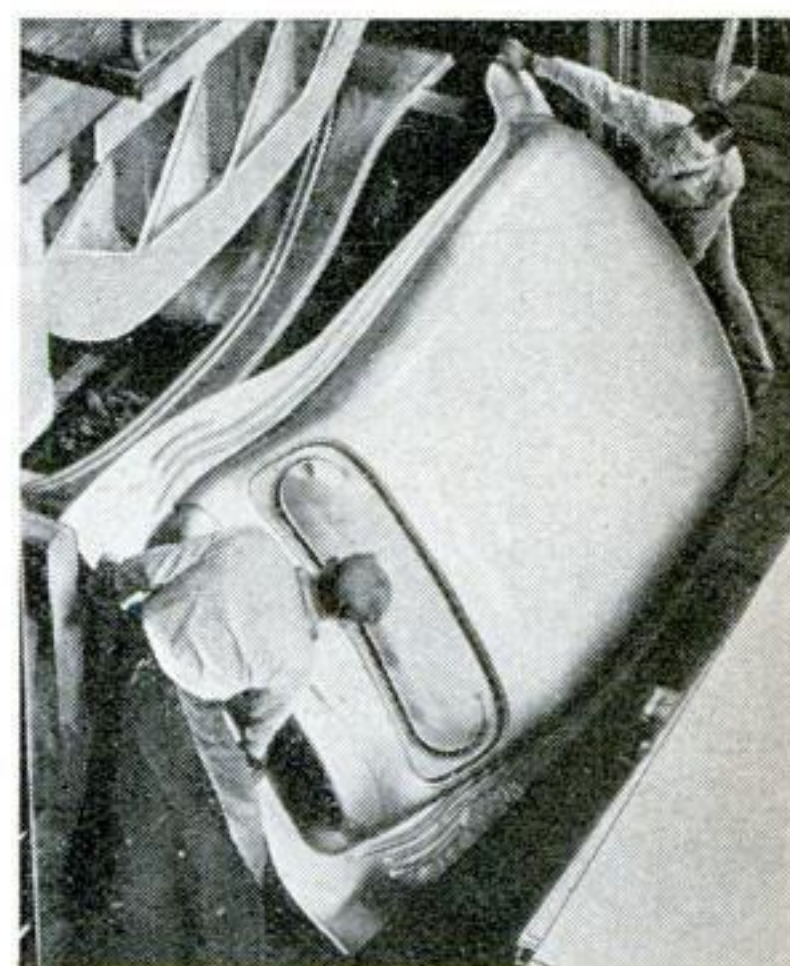
**3** **This Electric Arc** turns metal to vapor—shows all its elements! Plymouth's flexible, Amola steel springs resulted from such advanced metallurgy.



**4** **Bronze that's 1/3 Pure Oil!** Here's a Plymouth bushing made of marvelous Oilitite. It looks like solid metal...but under pressure, oil oozes out! Plymouth had them first among low-priced cars.



**5** **Fine as a King's Sword** is this steel crankshaft. It resists strain and vibration...has 4 main bearings...helps make Plymouth "smoothest."



**6** **Plymouth's All-Steel Body** is formed into beautiful lines under pressure of 3 million lbs. The body is safer—and quieter.



**7** **"Meteor" Heat Makes Safer Bodies.** This worker is welding a joint. Pioneering in metals made Plymouth one of the first cars with a Safety-steel body!



**8** **1938 Plymouth De Luxe 4-Door Sedan with Trunk** delivers in Detroit for \$815—other models as low as \$645—including Federal taxes. State, local taxes not included. See a Dodge, De Soto or Chrysler dealer. Plymouth Division of Chrysler Corporation, Detroit, Michigan. TUNE IN MAJOR BOWES' AMATEUR HOUR, COLUMBIA NETWORK, THURS., 9 TO 10 P. M., E.S.T.

**GET MOST FOR  
LOW PRICE**

## Plymouth Builds Great Cars



# POPULAR SCIENCE

Monthly

Volume 132

Number 4

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The auto-phonoscope, one of the strange new instruments that show us how we talk. Read about it in the article on page 32

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## 3 GRADES OF GASOLINE—3 GRADES OF CAR PERFORMANCE



**HERE'S WHY POWER DEPENDS ON THE GRADE OF GASOLINE YOU USE**

You'd be surprised to hear some of the "dizzy" ideas uninformed people get about their cars. They even expect top-grade performance from low-grade gasoline. Here's what a man can reasonably expect... and why:

**Poor performance with "low grade" gasoline**

There is no anti-knock fluid (containing tetraethyl lead) in "low grade" gasoline. Power is lost because the spark *must* be retarded by your car dealer to prevent "knock" or "ping."

**Good performance with "regular" gasoline**

Most regular gasoline has in it anti-knock fluid (containing tetraethyl lead). The spark can be considerably advanced for more power without "knock" or "ping."

**Best performance with gasoline containing "ETHYL"**

Gasoline "with ETHYL" is highest in all-around quality. It has *enough* anti-knock fluid (containing tetraethyl lead) so that the spark can be *fully* advanced for maximum power and economy without "knock" or "ping."

**TESTING CAR PERFORMANCE** on different grades of gasoline at an Ethyl Motor Clinic.

**ETHYL GASOLINE CORPORATION**, manufacturer of anti-knock fluids used by oil companies to improve gasoline.



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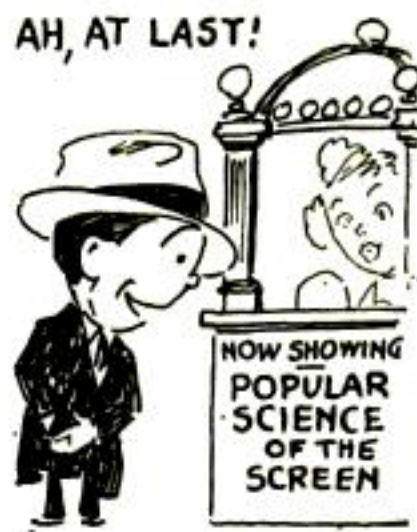
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# Our Readers Say

## He'd Like Us to Print On Colored Paper

YOUR magazine has been a favorite of mine for three years. I have found the letters in "Our Readers Say" section very interesting. There have been requests for more of this and that, but I do not think anyone could arrange the book to serve better the diversified interests of so many readers. The international flavor of the articles is commendable. I had long wished that "POPULAR SCIENCE of the Screen" would come to our theaters here, and was pleasantly surprised when the latest in the series was presented at a show recently. One improvement I would like to suggest. I think if the paper of this fine magazine was tinted to cut down the glare from the high finish, it would add to the enjoyment of reading it.—A.N.C., Lachine, Quebec, Canada.



## Says His Seed Experiments Were Mainly in the Field

IN AN item on my chemical process for treating corn seed, you stated that preliminary experiments had been carried on in laboratories and hothouses. Although some laboratory work has been done, the main development of the process was accomplished in the open fields. The planting and sowing of these treated seeds has been going on successfully on fields of extensive acreage over a period of three years, not only with corn but also with a variety of other seeds. This year, for the first time, I produced ripe corn in far-northern Wisconsin, a dairying area noted for its short growing season.—Howard D. Sallins, Chicago, Ill.

## He Likes Gears and Levers, But Not Cranks

HAVING been a reader of your magazine for several years, I was very happy, last Christmas, to receive a two-year subscription as a gift. I have always enjoyed P.S.M. for its interesting articles, home-workshop projects, and departments on chemistry and microscopy. However, when the February issue reached my mail box and I opened it, I was surprised to find an article on nudists, of all things. What do sensible people care about a lot of cranks who think it's smart to run around naked in a back lot? While the article had a scientific basis, it seems to me that the character of the experiments did not merit the treatment you gave them. Nudism is just a passing fad, so why flatter it with consideration in a scientific magazine?—C.R.M., Green Bay, Wis.

HEY, THIS NUDIST FUSS IS TRESPASSING ON MY TERRITORY!



## The Lady Monkey's Age Is No Secret Now

THE solution of D.L.H.'s problem about the monkeys is not what the reader's letter in the March issue said it is, it strikes me. I find that the monkey's mother is two and a half years old, making the rope fifteen feet long. Letting  $x$  equal the monkey's age when the monkey's mother was three times as old as the monkey, the age of the monkey's mother is found to be  $5x$ , and the monkey's age  $3x$ . Since the sum of these two ages is four years,  $x$  equals a half year,  $5x$  equals two and a half years, and  $3x$  equals one and a half years. The rope, therefore, weighs three and three-quarters pounds, and its length is fifteen feet, according to the conditions of the problem.—D.W.C., Medford, Mass.

## Divining Rods, Monorails, and Ghosts Interest This Reader

WITH regard to the question raised by J.C., of Charleston, S.C., I believe that if ghosts are semitransparent, then light will shine through them, so they will not affect the photo-electric cell. As for E.C.O., of Mobile, Ala., I read in a popular encyclopedia that the power to locate underground streams with divining rods was inherited, and only certain families could use it. I haven't seen anything in your magazine on model railroads of the overhead type that operate on a single upper rail. I suppose on a train of this type there would be no speed limit, providing the necessary power was available. I have very much enjoyed your articles on the laws of science, and hope to see them continued in the magazine for a long time to come.—J.S., Vancouver, B.C., Canada.



## Try This One Out on Your High-School Algebra

HERE is a problem given in a recent high-school algebra examination. Forty people wish to reach a point twenty-nine and a half miles away. The only available conveyance is a bus which has a capacity of twenty passengers and can go at an average speed of twenty-four miles an hour. The party is divided into two groups which start at the same time. The first group starts on foot, walking at an average rate of four miles an hour. The second group rides in the bus a certain distance and then walks the rest of the way at an average speed of three miles an hour. The bus returns to meet the first group and to carry it the rest of the way to the common destination. How far should each group walk in order that all may arrive at the destination at the same time? Incidentally, in seeking a solution of

the problem, disregard any of the possible variable factors involved in the stopping and starting of the bus.—E.D.C., Cincinnati, Ohio.

## A Good Way To Draw Good Free-Hand Circles

THIS little trick of drawing a good circle free-hand is probably old stuff—but I didn't know it, until the other day. Just lay the paper on a smooth table top; put the nail of your second finger where the center is to be; hold the pencil firmly with the point extended to the desired radius, and twirl the paper in a complete circle with your other hand. That's all there is to it. And you'll find it comes in handy.—P.F., Woodbridge, N.J.



## Only the Unusual Thrills This Stamp Collector

I HAVE been buying POPULAR SCIENCE off and on for several years now from my news dealer. My last buying spurt started with the December 1937 issue, when I read with interest the article entitled, "Stamp Detective Solves Mysterious Crimes." You've guessed it. I'm a stamp collector and would like to see a page or two devoted to stamps in every issue. Not the usual stuff found in regular stamp magazines, but something on the science of stamps like the detective piece. There's plenty of good stamp material that belongs in such a magazine as POPULAR SCIENCE.—L.L.McM., Benton Harbor, Mich.

## He Still Must Stoop To Pick Them Up

THE item on page 76 of your March issue suggesting mosquito netting as backstops and side walls for table-tennis outfits, prompted me to pass along a suggestion that will aid in retrieving balls that roll under the table. Being rather stout, I got tired of climbing under the table every few minutes to pick up balls. So I "borrowed" a length of strand rubber from a model airplane my youngster had flown into every article of furniture in the house. I tied one end of the strand to one leg of the table about an inch from the floor. Then I stretched the other end taut, and tied it to the leg diagonally opposite at the other end of the table. Throughout its length, the strand is of just the right height to stop and usually hold against the (Continued on page 7)

WHY NOT A PING PONG POOCH?





(Continued from page 6)

floor nine out of ten of the balls that roll under the table. All the player has to do is give the rubber strand a snap with the toe of his shoe and the ball is snapped out from under the table.—J.F.T., Tonawanda, Pa.

### Somebody Cable Him About the Rabbit

THIS is a relay station on the cable route between Vancouver and Suva. I am a medical officer to the cable company's staff of twelve on this remote spot in the middle of the Pacific. The cable signals come to us limping and feeble after their long journey, the longest in the world, of 2,500 miles from Bamfield, B.C. Our instruments here do a rejuvenation operation on them and send them off hopping nimbly on the 1,800-mile jaunt to Suva. Our nearest civilized neighbor is Honolulu, 1,100 miles away. To try to fight the awful boredom of our lonely existence, we cultivate hobbies. A few of us have taken to studying mathematics. We do most of our shopping with San Francisco firms by catalogue. Sometimes our "Frisco" agents, taking pity on our isolation, pitch a bundle of magazines into one of our quarterly cases. Irrespective of age, they are most welcome. And thus it happened that recently we had the good luck to get a few stray copies of your excellent publication, which have interested us in many ways. In particular, we got tremendous kicks out of a few math problems, one of which, the rabbit problem in the June 1937 issue, refuses to surrender to our elementary calculus. Perhaps if you let S.A.M. know our plight, he might come to our rescue. If so, a little bunch of derelict mathematical tyros in this God-forsaken speck in the Pacific wastes will ever bless your name.—J.J.O., Fanning Island, via Honolulu.

HOW CAN WE DO RABBIT PROBLEMS WHERE IT'S TOO SMALL TO GROW THEM?



### If the I. A. A. U. Hasn't Heard, Then Who Has?

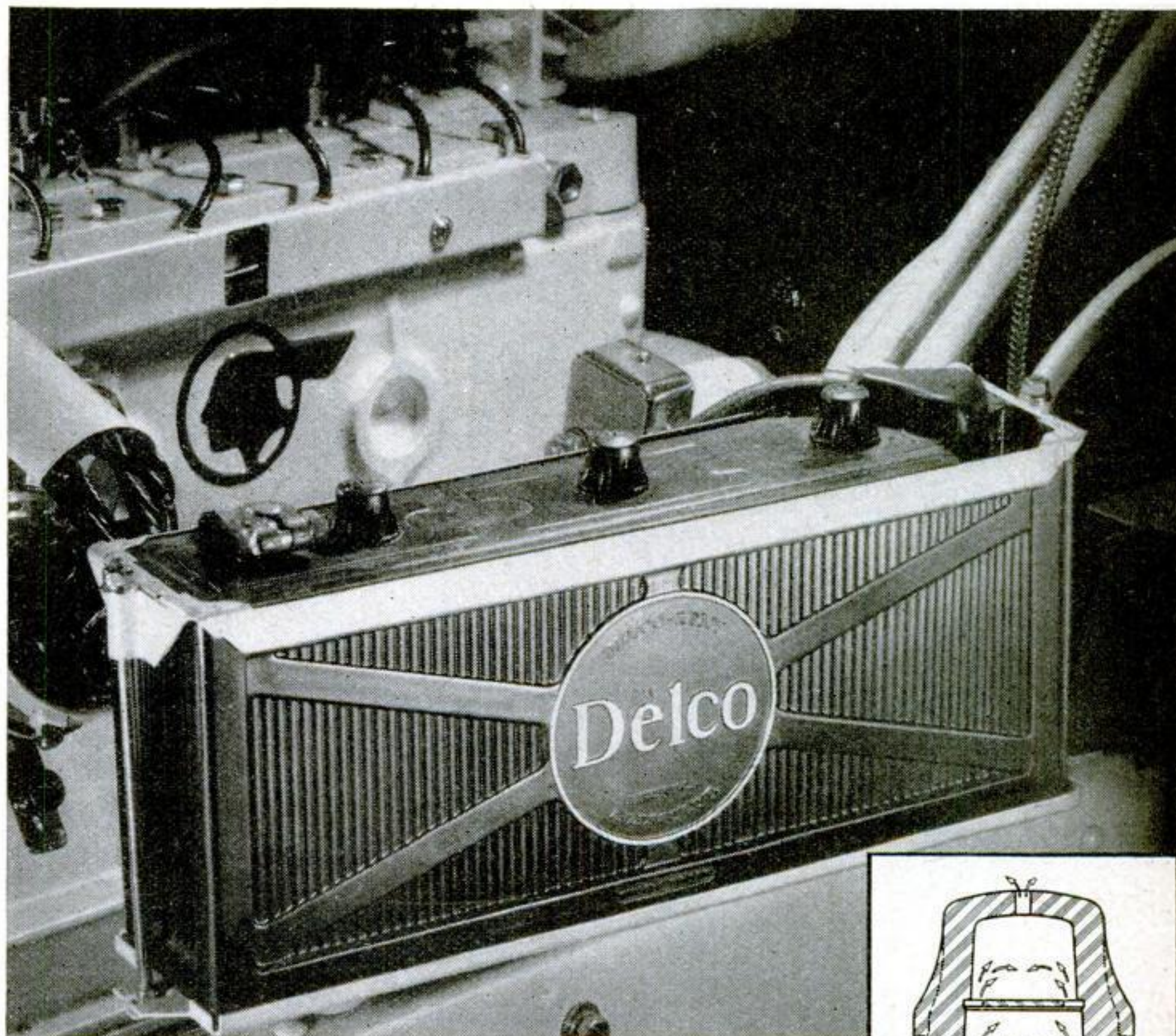
YOUR article, "Science Sets New Sports Records," makes me wonder whether, in some parts of the world, supposedly uncivilized races may have established records that the International Amateur Athletic Union has never heard of. We borrowed our crawl stroke in swimming from the natives of the South Sea Islands, and perhaps tribal athletes of other lands excel in the technique of different sports. I have read, for example, of the "pillar jumpers" of an island near Sumatra, where high-jumping is the native sport. Every village has a solid stone pillar, about six feet high, where contenders may match their skill. Leaps of seven feet and more have been reported. It is true that the natives take their last running step from a "take-off stone" a foot or so above the ground, and your article's

WHAT ABOUT THOSE NATIVE JUMPERS IN AFRICA?



(Continued on page 8)

## The new DELCO *End-to-End* BATTERY A REAL INNOVATION



A typical Delco end-to-end battery installation on a 1938 Pontiac.



**AUTOMOTIVE** mechanics and repair men have long felt the need for a battery that could be serviced conveniently. Delco-Remy engineers have met this need with the new Delco end-to-end battery, a real innovation. Mounted under the hood, this new Delco end-to-end battery provides these important advantages:

Easily seen—closer check can be kept on water level and other service needs.

Can be serviced without disturbing occupants of the car.

No possibility of acid damage to upholstery.

Sealed connectors minimize short-circuiting from tools inadvertently placed on the battery.

Double baffle vent plugs, as

illustrated, aid in condensing acid vapors, and prevent acid from escaping.

Corrosion and loose connections can be detected quickly and corrected easily.

Battery case cannot be damaged by thrown stones on gravel roads.

Shorter cable to the starting motor assures more reliable winter starting.

The new Delco end-to-end battery is standard equipment on all 1938 Buicks, Oldsmobiles and Pontiacs. Its long, narrow shape likewise makes it ideal for motor boats, trailers, and other uses. Sales and service requirements are available at United Motors Service Stations.



# Delco-Remy

ANDERSON, INDIANA

World's Largest Manufacturer of Automotive Electrical Equipment



## FOR MEN WHO DON'T MEAN MAYBE!



● Spick-and-span every minute is the first big **MUST** at Annapolis—and that doesn't mean maybe! Midshipmen have to be well-groomed—get clean, close, long-lasting shaves in *double-quick* time. Half-mown whiskers are out! Only perfect shaves pass inspections. That's why 7 out of 10 men at the U. S. Naval Academy use Gillette Blades in their Gillette Razors every morning.



● Your face is *always* on parade—wherever you go, night or day! Don't make it a proving ground for shaving experiments. Demand Gillette Blades and get the world's best shaves for *less than a cent a day!*

Speed shaving—tone the skin—with Gillette Brushless Shaving Cream made with peanut oil. Big tube 25¢.



## Our Readers Say

(Continued from page 7)

illuminating remarks about a jumper's center of gravity explain the advantage this would give them. Still, if they had to compete under our rules, I am wondering whether they might not be able to challenge even the remarkable record of six feet and ten inches made last year by Mel Walker of Ohio State.—E.D.F., Bridgeport, Conn.

### This Is Carrying It to a Fine Point

THERE are several ways of looking at the problem stated recently in "Our Readers Say," concerning the center of a spinning shaft. One way is this: The absolute center of a shaft is infinitely small. As the infinite smallness is approached—there being no limit to this—there would be something smaller than the smallest particle of matter. I cannot conceive of this having any mass. Hence, it seems to follow that it could have no motion. Another way of looking at it is according to the atomic theory. Breaking down the atom into its protons and electrons that are whirling through their orbits, we find that these are very widely spaced in relation to their sizes, and it is reasonable to assume that these particles rarely, if ever, cross the center of their unit of mass. In short, there is little likelihood that any part of any central atom in a spinning shaft ever crosses the center of the unit of mass of the shaft. Therefore a body such as this has no physical center. And if this is so, there is nothing either to stand still or to spin, except our heads from trying to figure out things like this.—D.R.S., Boise, Idaho.

HEY, DID YOU SAY  
A SPINNING SHAFT?



### A Practical Nudist Answers the Scientists

PERMIT me to say at the outset that I think the title of the article, "Science Studies the Nudists," in the February issue, is misleading, for the scientists are not studying the nudists but the effect of nakedness on themselves, presumably not nudists. It hardly seems scientific to say that, because of their own reactions to an environment to which they have not become acclimatized, they have discovered anything that justifies the title. My own experience and, more particularly, that of my children—all of us have been nudists for twelve years—is that systematic exposure to the sun and air renders the body more and more immune to temperatures that the average body would find too hot or too cold. And here is something your scientists should be interested in. During the twelve years, my children have been free from all illness, except for a few colds which have occurred only on their return to school. One of my children, now eighteen, has never experienced a single day's illness. I feel that if we consider why chickens or lambs born when the snow is on the ground are hardier than the later ones, or why the first leaves of sweet peas stand frost better than the later

(Continued on page 9)



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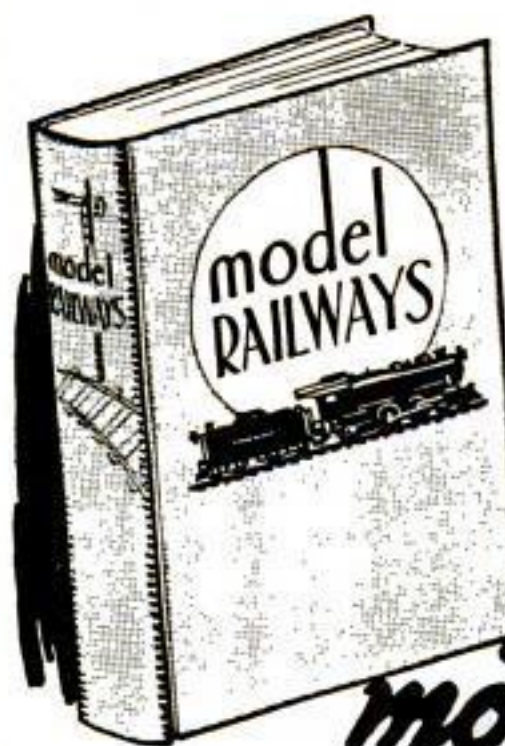
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(Continued from page 8)

ones, we are getting nearer to the science of the subject, which is one of heredity, environment, and acclimatization, rather than one of temporary, artificial rise and fall of temperature.—C.W., Redwood City, Calif.

### One-Man Duet Wants To Be a Trio

IN THE February issue, R.A., of Corvallis, Ore., announces his ability to hum one tune and whistle two others simultaneously. Good for him! He certainly "goes me one better." But will he please let a fellow in on the secret? I realize that unless R.A. is a head doctor, he may have some difficulty, but won't he please try? I'd like to add another voice to the two I wrote you about in the letter you published in December.—W.W.H., Woodlynne, N.J.



### That Artificial Spa Has Him Steamed Up

WHAT softies we are getting to be! First we had fireplaces that cooked us on one side while our spines froze on the other. Then we got steam heat that, despite its name, dried out the air until everybody caught cold. Then came air-conditioning, which is all very well as long as we stay in it, but makes us uncomfortable when we leave it even on the finest days. Now, of all things, I see in the March issue that some one has thought up a gigantic "artificial spa" that is to give us, by some wonderful magic, all the "benefits" of expensive health resorts, right in the heart of a city (for only \$6,000,000!). All this is progress in reverse. One good outing in the country, rain or shine, cold or hot, can do more for our health than all the artificial, hocus-pocus "treatments" put together. We're suffering from a national hypochondria, induced by just such ideas as this "artificial-spa" thing. Let's quit being hothouse softies!—B.T.N., New York City.

### Phonograph-Needle Changer Should Be a Repeater

ALTHOUGH I am very fond of the radio, the phonograph is my old stand-by. The ideal thing is a combination radio and phonograph. What I started out to write about is the item on page 102 of your March issue, describing a new phonograph pick-up arm in which needles may be inserted from the top, eliminating the annoyance of inserting them from the bottom. This is a splendid invention, as far as it goes. All that remains to be done is to work out a simple feeder that, at the touch of a button, will automatically drop a new needle into the hole as the old, dull one is released through the bottom. It ought to be a very simple matter to add this.—J.D.R., Cleveland, Ohio.

I'D TAKE UP GOLF IF SOMEBODY WOULD INVENT A ROBOT TO PLAY IT FOR ME!



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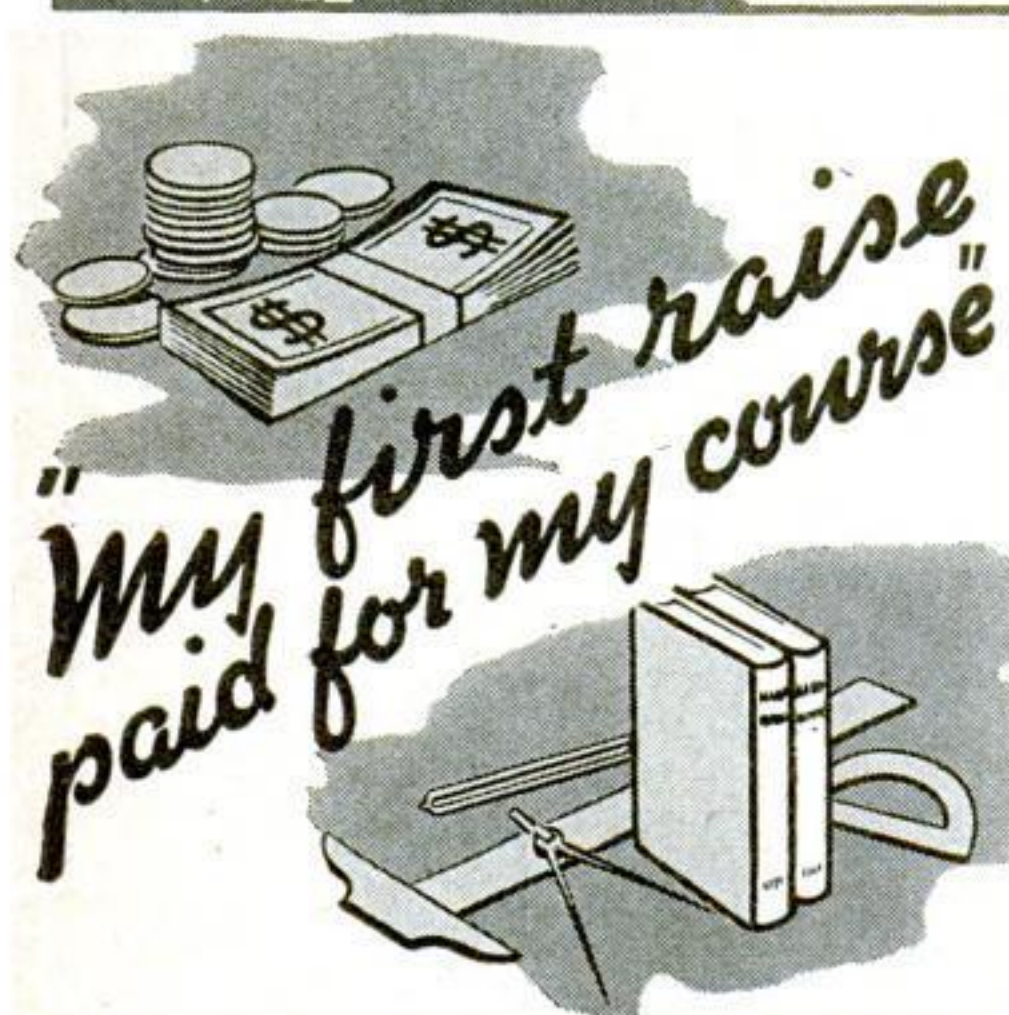
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My daily timekeeping trips through the plant furnished a fine opportunity to supplement theories by observation of machinery in operation. In a few months, knowledge derived from the course enabled me to talk intelligently with our engineers, firemen, machinists, and mechanics, until frequently they would ask me to explain the mechanical principles governing certain operations. In return, I received practical information not covered in books. While taking mechanical drawing, I took measurements of the machines, shafting, belting, and pulleys in our largest mill and drew a plan of same for practice. These plans were not mentioned to the manager, but before long he occasionally asked about certain things in manufacturing, which I must have answered in a way to show a fair knowledge of the workings of the plant in general.

Soon came an increase in salary and later a promotion to the position of chief clerk. Then I took a course in advanced accounting and office practice, which enabled me to make numerous improvements in office methods. In spare time, I took our monthly statements of manufacture and from them compiled a graph, showing at a glance the comparative cost of each department from month to month and a comparison of each month with the corresponding one for three years. This I mailed to the president of our company, who wrote me a very complimentary letter and asked that I instruct our clerks and those of allied companies in which he was interested to make future statements to him in graph form. Within six months, I was made general superintendent at about double the salary of chief clerk, with the opportunity to invest my savings with associated companies, thus gradually increasing my income. The men who had aided me in learning everything possible along practical lines, now coöperated for general improvement. Studies in lubrication resulted in a material reduction of the cost of oils and grease used in the mills and locomotives. Close attention to elimination of waste of raw material

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In 1925, I returned to high school. Frankly, the instructors said I'd be rusty. Better carry the minimum amount of subjects. But I wanted to get through as quickly as possible, and insisted on taking everything the law allowed. And at that, I found the going fairly smooth. Not that I was any brighter than my fellow students, but simply because the home-study course had taught me to dig things out for myself, to get the "why" of things and not be satisfied with just getting the answers that appear in the back of the book. Then, too, the lessons had taught me the use of the slide rule, trigonometry, and log tables, all deep, dark mysteries to my fellow sophomores. I could run through a whole set of calculations in physics, while they were wading through the figures of the first problem. Consequently, I finished the remaining three years in two, and graduated with honors.

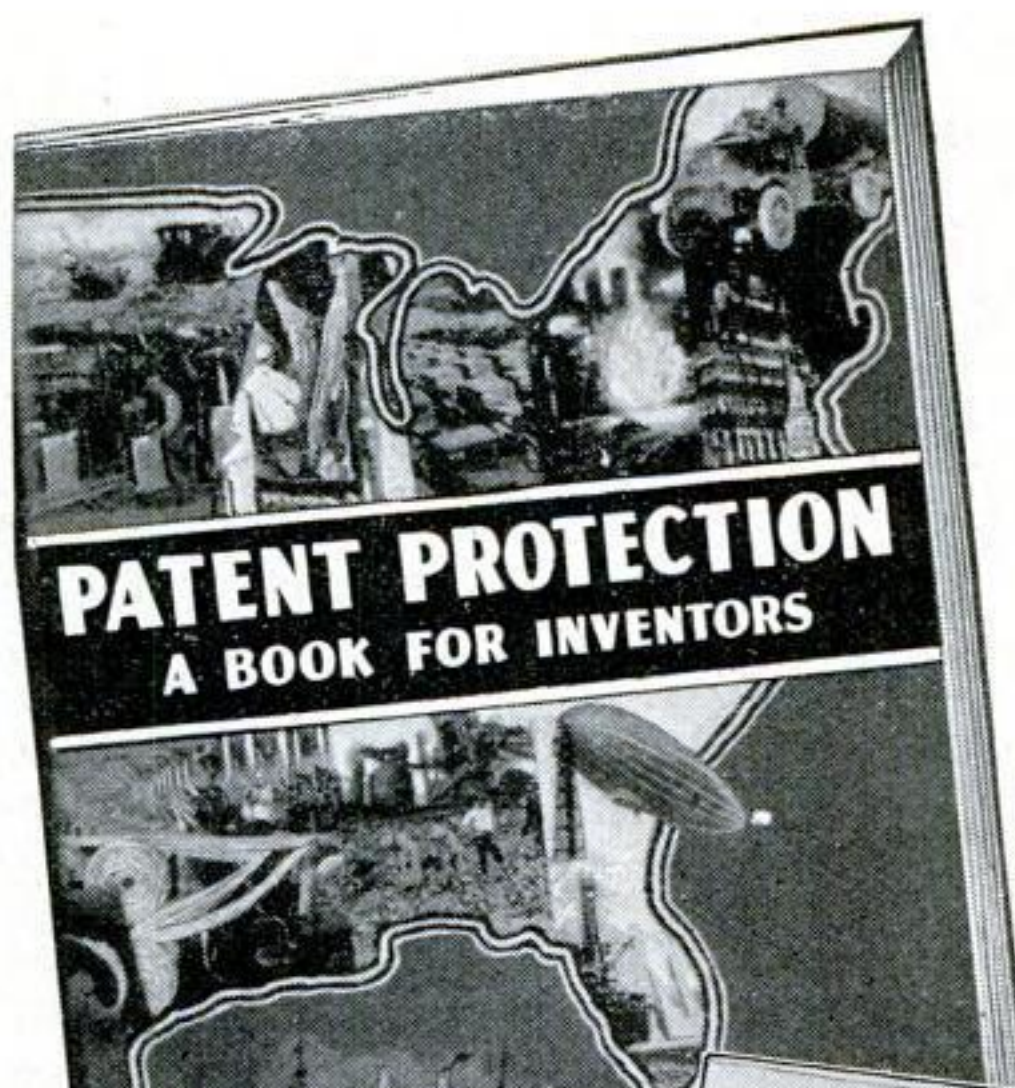
Although I used the texts and tables from my home-study course both in college and afterwards working as a draftsman for the \_\_\_\_\_ Co., I practically forgot about ever taking it. But when my job folded, and no lead was too trivial to follow for another, I thought of the course taken years before. I remembered that the school maintained an employment bureau. Cynically, I believed it a mere publicity stunt. But I was never more in error. They answered my letter, sent me a card to fill out, and not one sheet of advertising. Still cynical, I pondered. "Just a gag. They'll file the card in the waste basket and in a few weeks flood me with pleas to enroll in another course."

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## Secrets of Success

hear from them, it was several months later, and it wasn't in the form of a high-pressure sales talk, or even a memo on the benefits to be derived from further study. Rather, it was a notice of an opening in a near-by concern.

In the meantime, I had returned to my former work. Nevertheless, that letter meant a great deal to me. It knocked the "chip" off my shoulder. It restored my faith in humanity. And the next time I need a job, I know one of the first places to write. And that is to the \_\_\_\_\_ Schools. They are still ready to pull for me, even though I finished over ten years ago.—*F. J. M., Portsmouth, R. I.*

## HE GIVES THE CATFISH SOME CREDIT, TOO

WHEN I was mustered out of service at the end of the Spanish-American War, I was married and had three children. What to do for a living? The only thing in sight was to rent a piece of land and try farming. In the spring of 1899 we moved to the farm for a try-out, but money was scarce.

What could I do to improve the family's financial outlook? I had finished the eighth grade at the country school. Not so good! I decided to prepare myself for a civil-service job and, since I had always liked the smell of coal smoke, I picked the railway mail service, enrolling with the \_\_\_\_\_ Schools.

When I was ready to try out for my job, I learned that the preliminary examination was to be held in a town forty miles away, on the other side of the Missouri River. The evening before the date of the test, I left home, carrying a lunch in a paper bag but with no money in my pocket. I planned to borrow a skiff to cross the river and bum a ride on a train the rest of the way.

I had just reached the middle of the river when I heard a muffled roar upstream. Fishermen had set off some dynamite, as they often did in those days. I proceeded with caution and soon, to my surprise, a stunned channel catfish came to the surface near-by. By careful maneuvering, I got the fish into my boat. It was a sizable catch, about thirty inches long.

With my pocket knife I dressed my find, and sold it to a butcher in a town on the other side of the river. With the money he gave me, I boarded a passenger train for the rest of my trip.

Thanks to my \_\_\_\_\_ Schools training, I found the examination easy, and received a position within a year. I worked along at good pay for nearly twenty-seven years. Then I was in a train accident and was incapacitated for further service. I was retired with the customary annuity which, together with my Spanish-American War pension, makes my wife and me feel quite well off in our old age. I give most of the credit to the

## 23 LANGUAGES

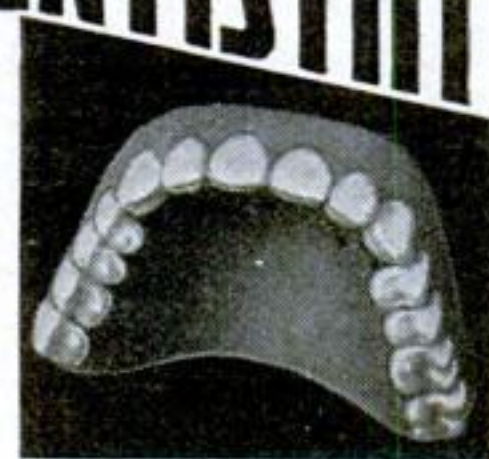
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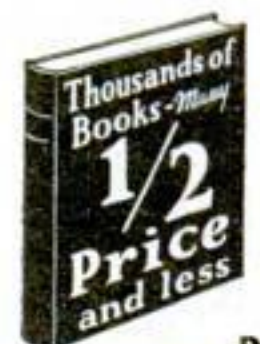
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## Secrets of Success

training I received from the good old Schools, though I must admit that the catfish had something to do with it, too.—C. C. H., Doe Run, Mo.

### More \$5 Prize Winners

THREE prize-winning letters in POPULAR SCIENCE MONTHLY'S Secrets of Success contest—"What Home Study Has Meant to Me"—are printed above. Read these stories carefully, because your own career may be just as interesting and inspiring to other readers. If you think so, put it down on paper and send it in. We will pay \$5 for every letter we publish.

### CONTEST RULES

Only letters from bona fide home-study school students will be considered and these must contain the name of the school and the name of the company, or companies, for which you have worked since graduation. (Names, however, will be deleted from the letters when published.) We also want to know the kind of course you took and the type of position you have held. Your own identity will be kept anonymous, if desired.

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## Device Takes Daytime Pictures of Lightning

SENSING lightning before it strikes, an electric relay designed by Prof. B. F. J. Schonland, of Witwatersrand University, South Africa, opens the shutter of a camera in time to catch daylight photographs of lightning bolts, a feat that hitherto was virtually impossible. Although nighttime photographs of lightning are easily taken by pointing a camera, with its shutter open, at an approaching storm, and waiting for a flash, the procedure does not work in the daytime because the long exposure destroys the film. Since most thunderstorms occur during the daytime, Professor Schonland wanted a device to photograph these discharges too. His unit employs a radio antenna to pick up the invisible electric discharge that precedes a lightning flash. The discharge operates a relay which opens the camera shutter within two one-hundredths of a second, well ahead of the main flash that is to be photographed at snapshot exposure.

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"I knew nothing about Radio. After four lessons I began servicing Radios, earning \$50 the first month. Last winter I made as high as \$100 a month in spare time."—G. F. WALTON, 808 West Olney Road, Norfolk, Va.

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### Many Make \$5, \$10, \$15 a Week Extra in Spare Time While Learning

Almost every neighborhood needs a good spare time serviceman. The day you enroll I start sending Extra Money Job Sheets showing how to do Radio repair jobs. Throughout your training I send plans and ideas that made good spare time money for hundreds. I send Special Equipment to conduct experiments, build circuits, get practical experience. I GIVE YOU A COMPLETE, MODERN, PROFESSIONAL ALL WAVE, ALL PURPOSE RADIO SET SERVICING INSTRUMENT TO HELP SERVICE SETS QUICKER—SAVE TIME, MAKE MORE MONEY.

### Find Out What Radio Offers You

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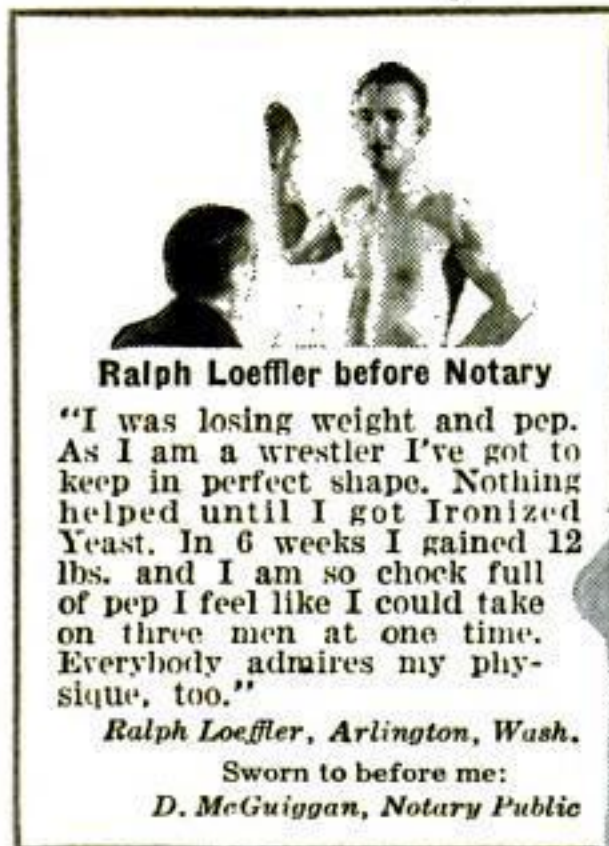
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# ON OATH SWEARS HE GAINED 12 LBS., NEW PEP, THIS WAY



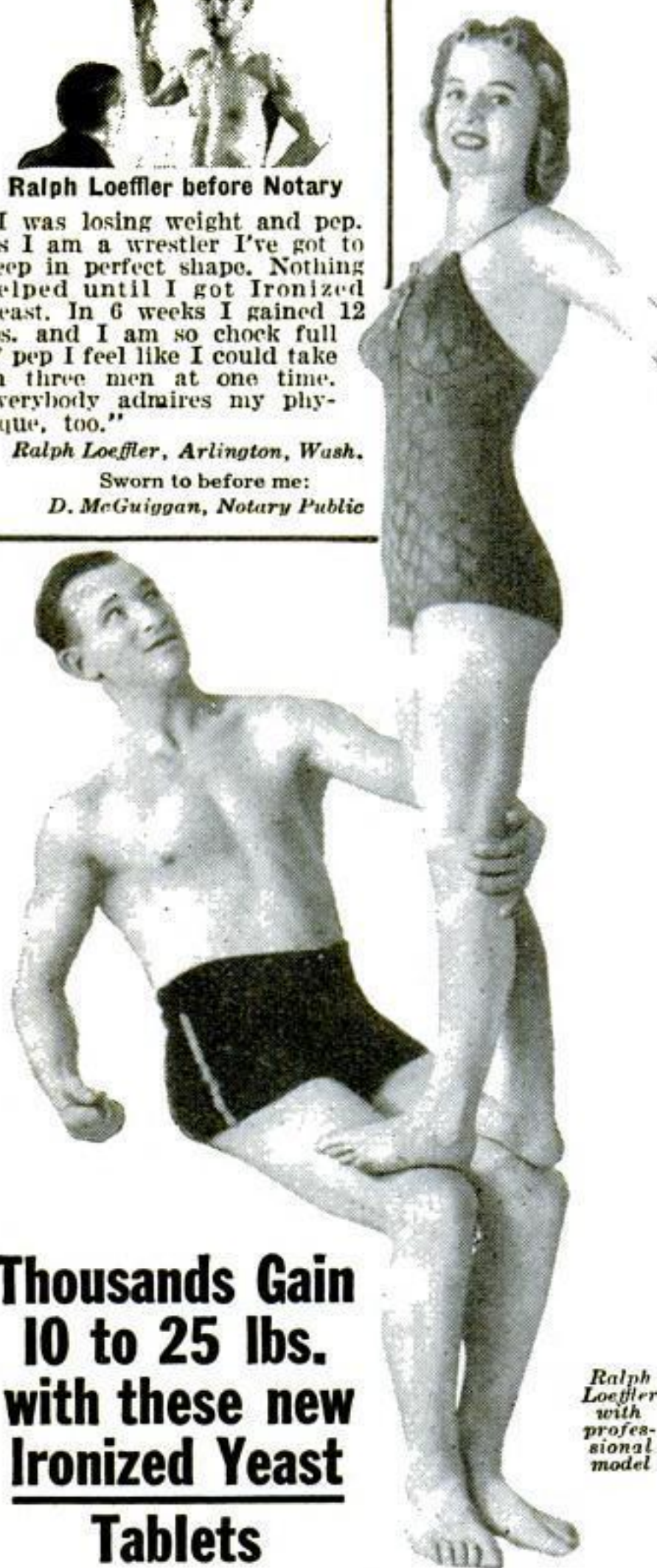
Ralph Loeffler before Notary

"I was losing weight and pep. As I am a wrestler I've got to keep in perfect shape. Nothing helped until I got Ironized Yeast. In 6 weeks I gained 12 lbs. and I am so chock full of pep I feel like I could take on three men at one time. Everybody admires my physique, too."

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Ralph Loeffler with professional model

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## Why they build up so quick

Scientists have discovered that thousands are thin and rundown only because they don't get enough Vitamin B and iron in their daily food. Without these elements you may lack appetite and not get the most body-building good out of what you eat. Now you get these exact missing elements in Ironized Yeast tablets.

They're made from one of the richest known sources of health-building Vitamin B—the special yeast used in making English ale. By a new costly process, this rich yeast is concentrated taking 7 pounds of yeast to make just one pound of concentrate—thus making it many times more powerful in Vitamin B strength than ordinary yeast. Then 3 kinds of strength-building iron and pasteurized English ale yeast are added.

No wonder, then, that these new easy-to-take little Ironized Yeast tablets have helped thousands of the skinniest people who needed their vital elements quickly to gain new normally attractive pounds, new energy and pep.

## Make this money-back test

Get Ironized Yeast tablets from your druggist today. If with the very first package you don't begin to eat better and get more benefit from your food—if you don't feel better, with more strength, pep and energy—if you are not convinced that Ironized Yeast will give you the pounds of normally attractive flesh you need—the price of this first package will be promptly refunded.

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How the transfer papers are applied. After soaking, the design is pushed partly off the backing paper. Then the projecting edge is pressed to the wall and the backing removed

## Decalcomanias Decorate Blank Walls

AVAILABLE in a wide variety of designs, including sailboats, lighthouses, and circus scenes, a new type of decalcomania makes it easy for the home owner to decorate bathroom, kitchen, nursery, or play-room walls. No glue, paste, or varnish is necessary in applying the transfer papers, and the designs are said to last indefinitely if properly cleaned from time to time. After the decalcomania has been soaked in warm water, the design is pushed off the backing paper until it projects about two inches from the edge. The wall surface is then moistened, the transfer paper placed on it

face up with the projecting edge pressed to the wall, and the backing paper stripped off. Rubbing it gently with a damp cloth while holding it in place with the fingers, will flatten out the design on the wall.



## Novel Adapter Units Electrify Oil Lamps

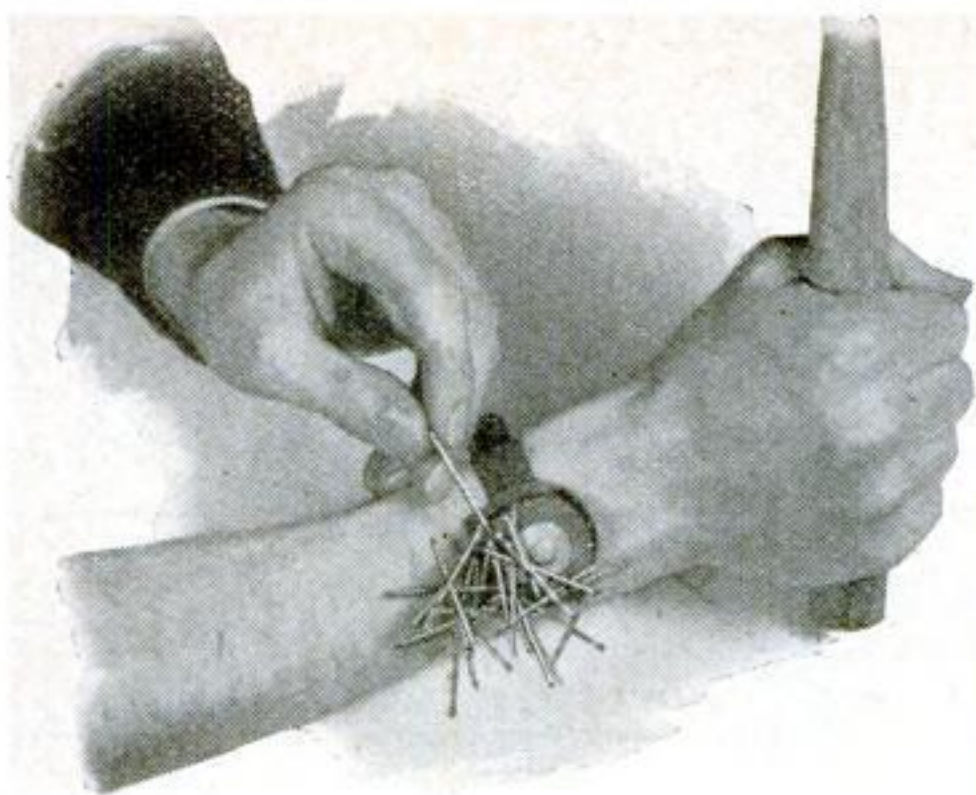


Three types of adapter units for oil lamps. The two above have candle-flame bulbs, while the one at the right simulates a low flame



OIL LAMPS can be electrified without drilling or mechanical changes by novel adapters now on the market. Made in two sizes, the units take the place of the oil wicks and serve as sockets for candle-flame lamp bulbs, thus making it possible to put antique oil lamps to a practical use. A special adapter in one type of lamp simulates an oil lamp that is turned down low, with only the glow from the wick showing above the burner.





## Magnet Worn on Wrist Holds Nails or Tacks

WORN like a wrist watch, a magnet accessory just introduced is handy for holding nails, tacks, screws, or other metal fasteners while using a hammer or screw driver. The magnet is securely attached to a leather backing fastened to a strap that buckles around the wrist. Nails and tacks clinging to the magnet are within easy reach, making it unnecessary to hold them in the mouth or carry them from one place to another in a box. The unit is equally handy for use by designers and dressmakers to hold pins in a convenient place.

## New Rubber Compound Holds Rugs in Place

RUGS can be prevented from slipping on a smooth floor surface with a new rubber compound. A special powder is first dusted on the back of the rug. Over this a liquid material slightly thicker than water is brushed on. When this dries—a process requiring from three to twenty-four hours, depending on the weather—it is said to hold the rug securely to the floor, and yet permit it to be moved or dragged about as desired. The non-slipping treatment is also said to preserve the nap, and give an inexpensive rug the solid body characteristic of expensive Oriental types.

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Q.—CAN I use a spray gun to do a painting job on my house? If so, what equipment will I need, and how shall I use it?—T.R.F., Hackensack, N.J.

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(Continued on page 21)



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## Questions from Home Owners

(Continued from page 15)

to cover windows and other surfaces that are not to be painted, and practice first on the rear of the house until you become accustomed to the operation of the gun.

### Sizes of Wall Paper

Q.—WHAT is the difference in size between single and double rolls of wall paper?—G.K.L., Richmond, Va.

A.—MOST single rolls of wall paper are eighteen inches wide and eight yards long, while double rolls consist of two singles joined as one. Some special papers are generally sold in bolts having three single rolls thirty inches wide and five yards long.

### Reroofing a House

Q.—IS IT any harder to reroof a house with composition shingles than wooden ones, and is the procedure the same?—N.N.R., Chattanooga, Tenn.

A.—IT IS claimed that whether you reroof your house with wood or composition shingles makes little difference so far as the work is concerned, since in either case the procedure will be the same. Always start at the bottom edge and work toward the ridge. Use long box nails instead of ordinary shingle nails to insure a good anchor through the old roof, which in most cases will serve as a good foundation for the new one.

### Mending Breaks in Sidewalk

Q.—HOW can I repair a break in our sidewalk, caused, I believe, by the heaving of frosted ground?—L.H., Little Rock, Ark.

A.—CAREFULLY remove all broken pieces and clean the surface with a stiff brush to remove even the smallest bits of loose cement. If the break is smooth, roughen the surface with a cold chisel to insure a good bond with the new cement. Mix three parts of sand with one of cement, add enough water to make the mixture smooth, and apply over the break. Sprinkle a little pure cement on the wet surface and trowel it smooth. If the cement is in any danger of freezing, cover it with burlap or straw.

### Matching Mixed Paint

Q.—I AM doing a painting job in a color I mixed myself. I do not know the proportions of each color I used, but have tried to get the same shade in a new batch I made to complete the work. How can I make sure they match?—B.J., Pasadena, Calif.

A.—ONE way of making sure is to coat one-half of a small square of ordinary window glass with the original paint and the other half with the new mixture. When they dry, both the color and the gloss can be compared easily, simply by holding the sheet of glass up to the light.



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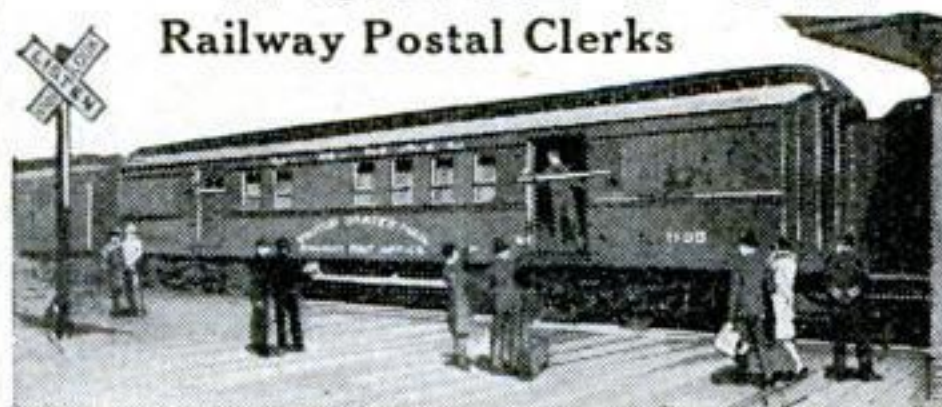
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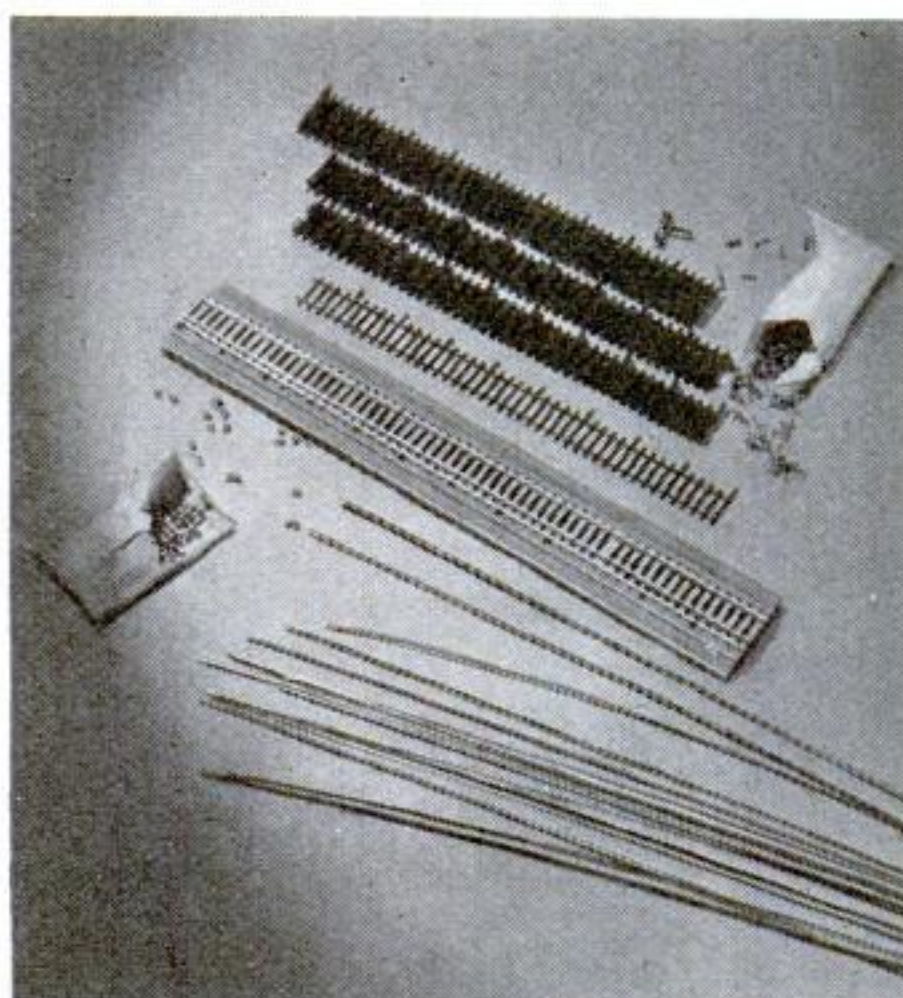


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(Continued on page 23)

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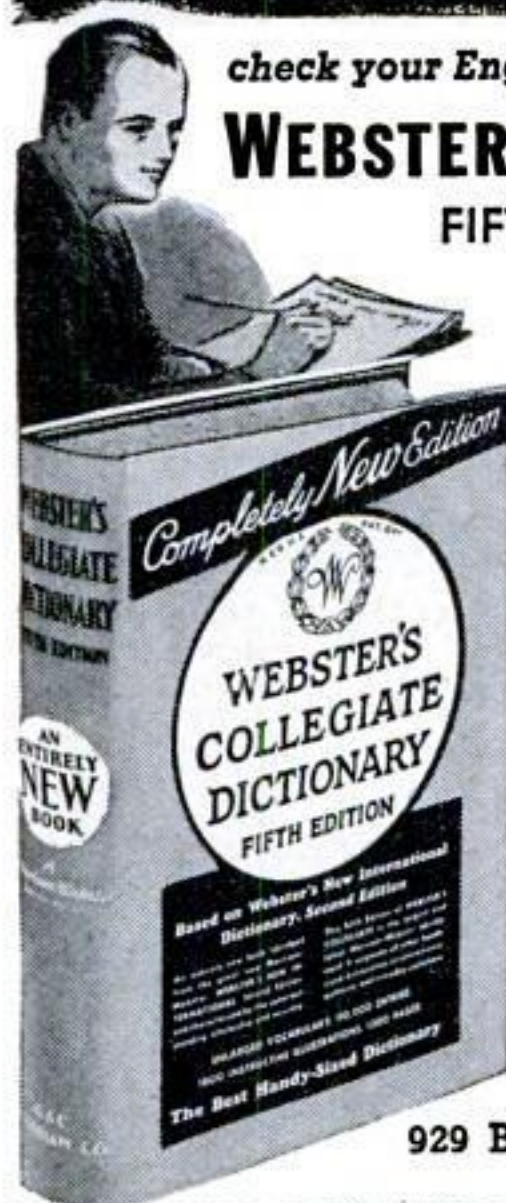


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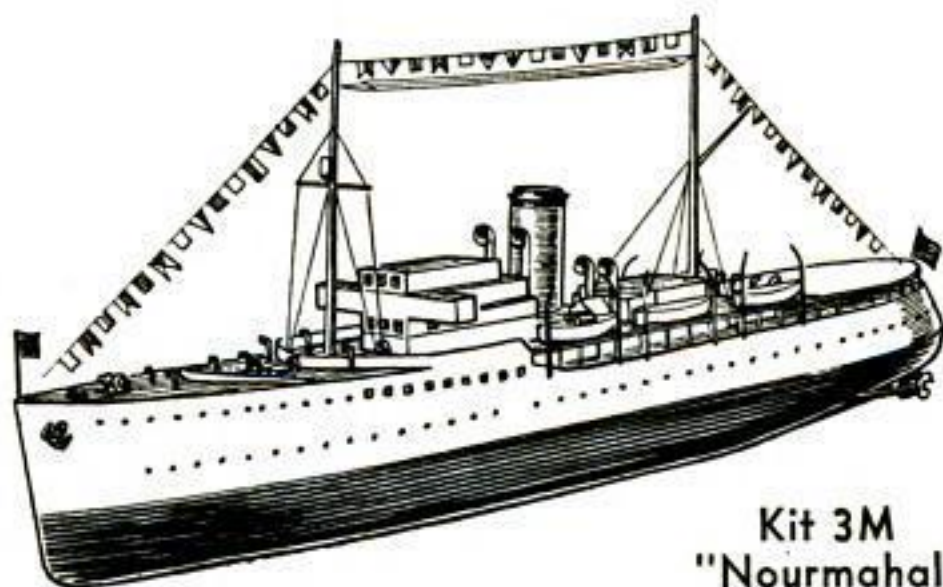
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**Kits for Model Makers**

(Continued from page 22)



Kit 3M  
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- U. *Hispaniola*, the ship in "Treasure Island," 7-in..... .50
- Z. H.M.S. *Bounty*, 11½-in..... 1.50
- 2M. Ocean freighter, 14-in..... 1.50
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- 4M. Oil tanker, 14-in..... 1.50
- 5M. Liner *President Lincoln*, 14¼-in. 1.50

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- F. Liner S.S. *Manhattan*, 12-in..... 1.00
- H. Cruiser U.S.S. *Indianapolis*, 12-in. .... 1.50
- J. Clipper ship *Sea Witch*, 13-in... 1.50

**STANDARD SHIP MODEL KITS**

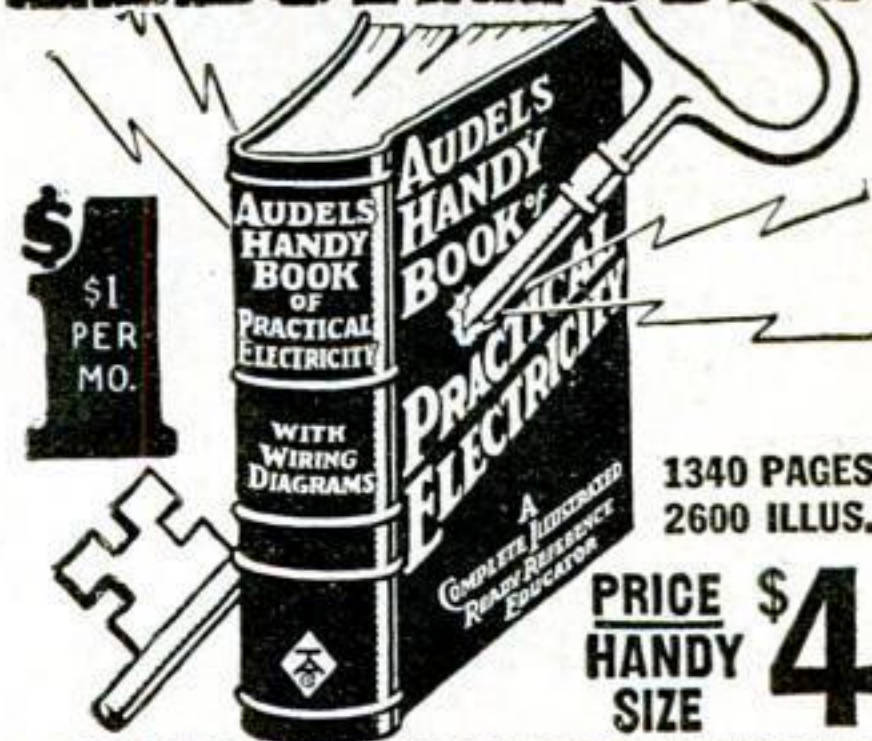
- A. Whaling ship *Wanderer*, 20½-in. hull, 27½ in. over all..... 7.40\*
- D. Spanish galleon, 24-in. hull, 30 in. over all..... 6.95\*
- E. Battleship U.S.S. *Texas*, 3-ft.... 7.45\*
- G. Elizabethan galleon *Revenge*, 25-in. hull, 28 in. over all..... 7.25\*
- L. Farragut's flagship *Hartford*, steam-and-sail sloop-of-war, 33½-in. hull, 41 in. over all..... 8.45\*
- Q. Privateer *Swallow*, 12½-in hull, 20 in. over all..... 4.95†
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- Y. Trading schooner, 17½-in. hull.. 4.90†
- 2S. U. S. Navy destroyer *Preston*, 31½-in. hull..... 5.95\*
- 3S. *Constitution* ("Old Ironsides"), 21-in. hull, 31 in. over all..... 6.50\*
- 4S. Clipper ship *Great Republic*, 31½-in. hull, 42 in. over all... 8.40\*
- 5S. Coast Guard patrol boat of new 165-ft. class, 20½-in. hull..... 4.95\*
- 6S. Brig *Malek Adhel*, ¼-in. scale, 20-in. hull, 33 in. over all, frame-and-plank construction.. 9.75†
- 8S. Fishing Schooner *Bluenose*, 17½-in. hull, 22 in. over all..... 4.95†
- 9S. Whaleboat, 14 in. long; partly shaped hull and raw materials for making all equipment..... 2.75†
- 10S. Confederate raider *Alabama*; steam sloop, bark rigged; 3/32-in. scale; 21½-in. hull, 28 in. over all ..... 8.20\*

(Continued on page 24)



Kit F—S.S. "Manhattan," 12 in. long

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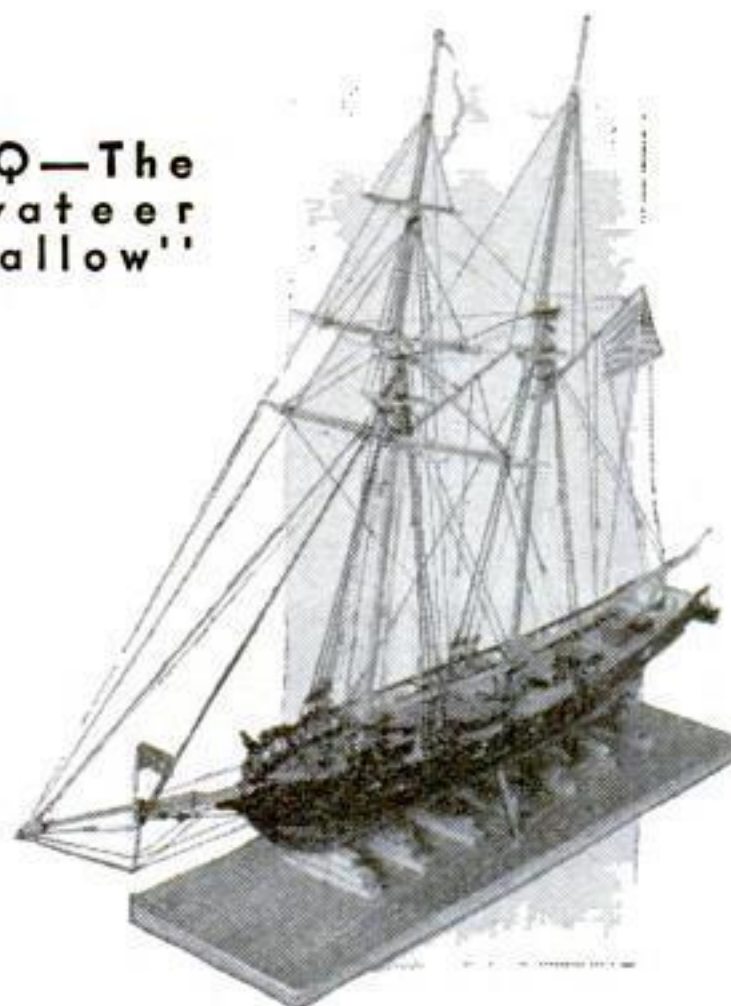
## Kits for Model Makers

(Continued from page 23)

### MODEL RAILWAY KITS

- 1L. Model locomotive, Hudson type HO gauge. Kit contains all the necessary sheet brass, brass tubes, rods, wire, springs, fiber, screws, boiler head, ladder strip, six driving wheels, and ten pairs of wheels. Locomotive and tender are 14 in. long ..... 9.95\*
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- 3L. Track kit. Contains running rail, third rail, cardboard ties, spikes, etc. for making 25 ft. of HO track..... 4.00\*
- 4L. Deluxe track kit. Same as 3L except that kit contains third-rail chairs, which eliminate much of the soldering..... 6.95\*

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- No. 10. Copycraft whittling kit for making one of several Hobo Hank novelties. Includes master model 5¼ in. high..... 1.50

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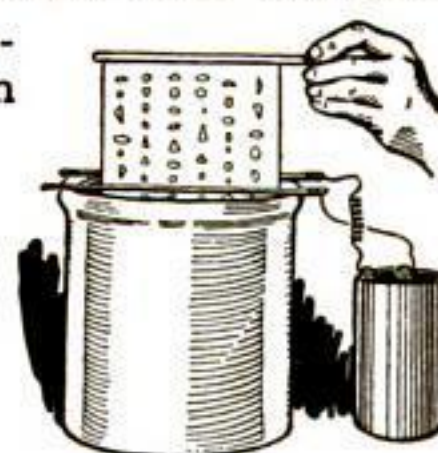
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## ALL YOU NEED TO KNOW IN ONE PRACTICAL HANDBOOK

Written especially for the amateur, this book tells you how to utilize many odds and ends to build a complete home electroplating workshop. Instructions, pictures, and diagrams show how easy you can do copper, nickel, chromium, silver and gold plating. How you can plate household or automobile fixtures, hardware, tools, silverware, ornaments, clocks, watches, bracelets, rings, metal parts of all kinds.

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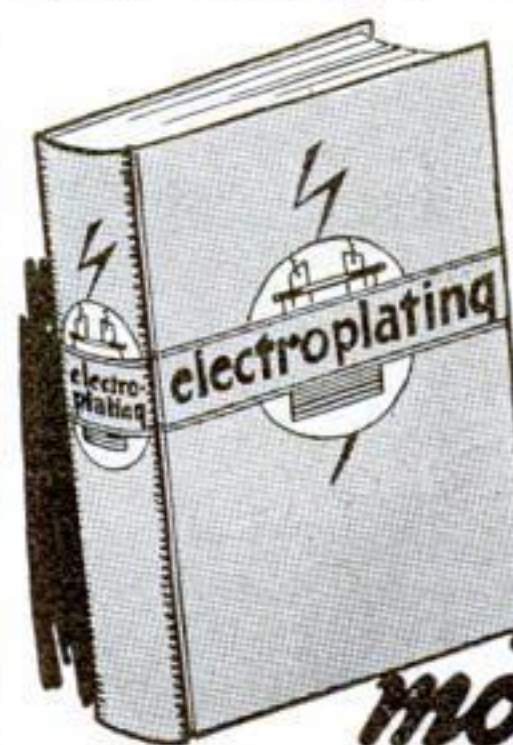


wood—fabric—leather—plastics—glass or porcelain. You can get results plating less commonly used metals such as zinc, cadmium, cobalt, antimony, lead, rhodium, and alloys. How to do lacquering, inlaying, overlaying, etching. How to plate unusual designs with contrasting metals for striking effects,—obtain unusual finishes with chemical coloring. Scores of illustrations, diagrams, and pictures make it easy to do electroplating in all its branches.

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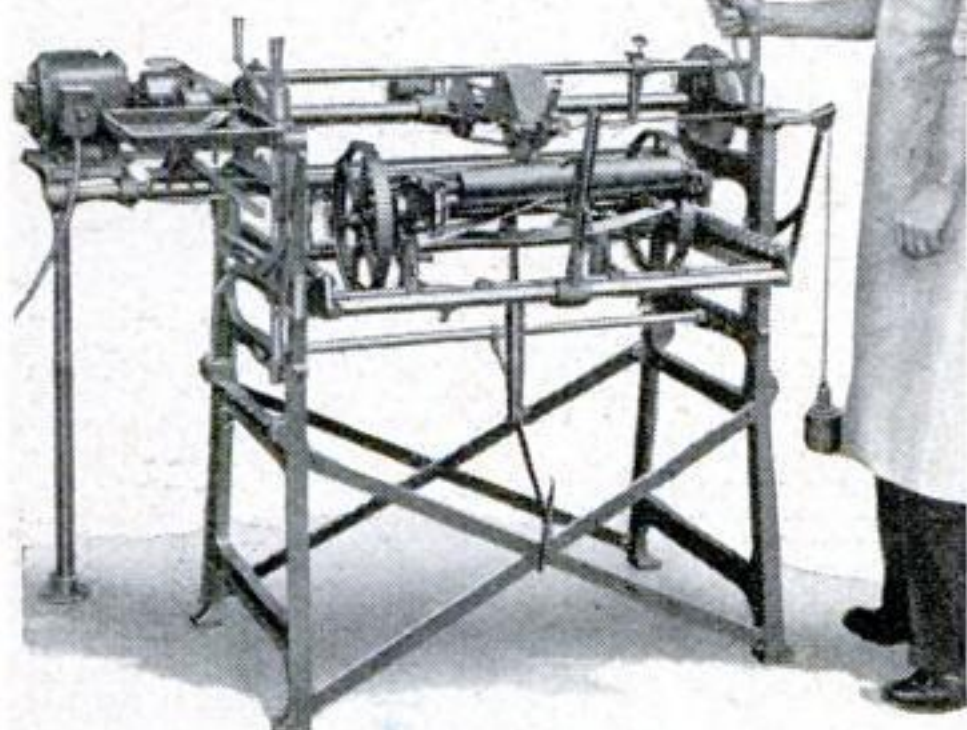
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## Novel Electric Lock for Automobile Doors

LOCKING automobile doors while the car key remains in the ignition lock, thus leaving the driver without means of getting back into his car, is made impossible by a new electric control.

(Continued on page 26)

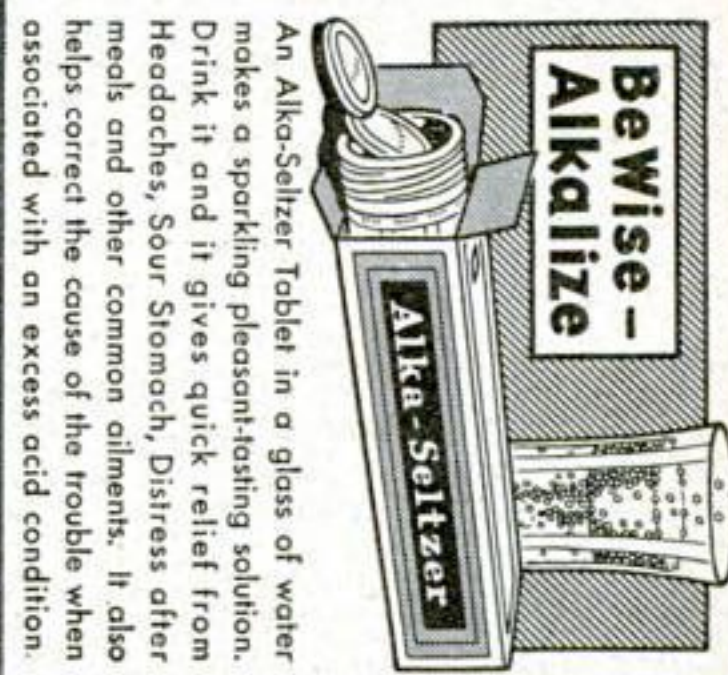
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(Continued from page 25)

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## Hand-Powered Motor Operates New Razor

HAVING vibrating cutting edges like those of the conventional electric razor, a new shaving device devised by William J. Kendall, of Lansing, Ontario, Canada, requires no electricity for its operation. The user simply squeezes the handle as he guides the razor over his face. The pressure operates a ratchet that moves the cutting edges to provide a shearing motion.

## Automatic Grinder Makes Meat Patties



MEAT patties for "hamburger" steaks no longer need be made by hand from guessed-at quantities of chopped meat. A novel machine just devised grinds the meat, and then automatically forms a measured quantity of it into a patty of just the proper size for cooking. The device is expected to be a boon to butchers and operators of roadside stands.

## Air Vents At Sides Keep Awnings Cool

AWNINGS that ventilate themselves are the invention of Wilbur F. Crawford, of Waco, Tex. Because sunlight beating down on window awnings creates a pocket of warm air which has no means of escaping, Crawford's plan is to leave an opening at the top of each side wall of the awnings. Over this opening a triangular piece of the awning material slightly larger than the opening is fastened, with its lower edge extending below and on the outside of the opening. Sewed in place so that this

(Continued on page 27)

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(Continued from page 26)

lower edge bulges slightly outward from the side wall, the extra material forms a vent that allows warm air to escape, yet prevents rain from entering.

## Perforated Bricks Are Linked by Metal Rods

A NEW type of steel-reinforced brick construction has been invented by Emmett V. Poston, of Springfield, Ill. The bricks are perforated through their shortest dimension with two or more holes. To construct a reinforced wall of a building or other structure, the first layer of bricks is laid in the conventional manner. Steel or iron rods are then inserted in the holes of the bricks. New bricks are then lowered into place so that the rods penetrate their holes as well. Mortar applied in the usual manner separates the layers of bricks from each other, while additional mortar forced into the holes around the rods binds the layers securely together. The uniform placing of the holes near the ends of the bricks permits the construction of even-surfaced, steel-strengthened corners.

## Odd Hat Comes Apart for Easy Cleaning



MADE so that it can be taken apart for cleaning, washing, or ironing, a lady's hat designed by Miss Marguerite Miller, of Great

Neck, N.Y., consists of a ribbonlike spiral of cloth. Starting at the top of the crown, a slit winds downward to the brim which is detachable. Fasteners keep the slit closed while the hat is being worn.

## Car-Wheel Device Cuts Radio Static

BECAUSE the front wheels of automobiles are electrically insulated from their axles by a film of lubricating oil or grease at all times, two Detroit, Mich., inventors devised a system of "grounding" the wheels to their axles, thus reducing static interference on car radios induced by the spinning wheels. A contact within the wheel hub connects the metal wheel with the axle end, even when the wheel is revolving, eliminating the source of radio interference for motorists.

## Shears Speed Up Work

DESIGNED to speed up the clipping or trimming of hedges and other shrubbery, novel shears invented by Joseph Wittek, of Pasadena, Calif., have multiple cutting blades instead of the usual single pair. Mounted side by side on the same frame, the cutters are operated by one pair of handles held in the hands. Instead of cutting a single swath, the device cuts six.

# Inventors

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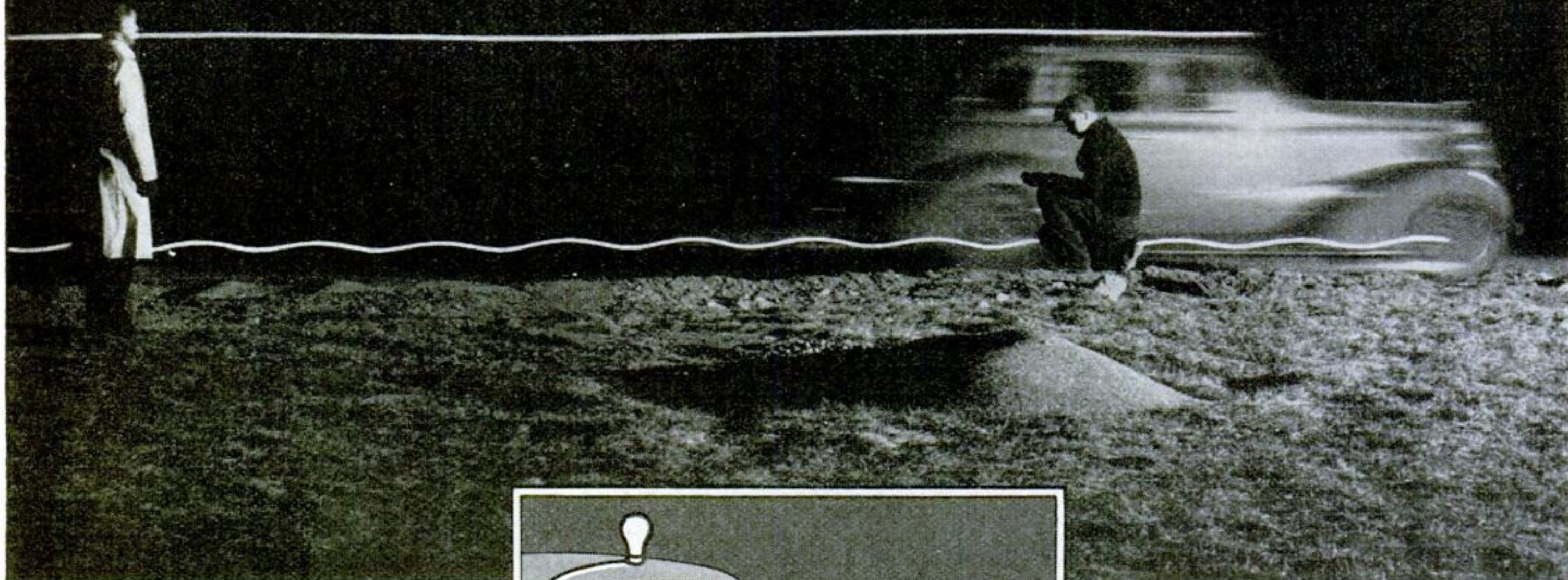
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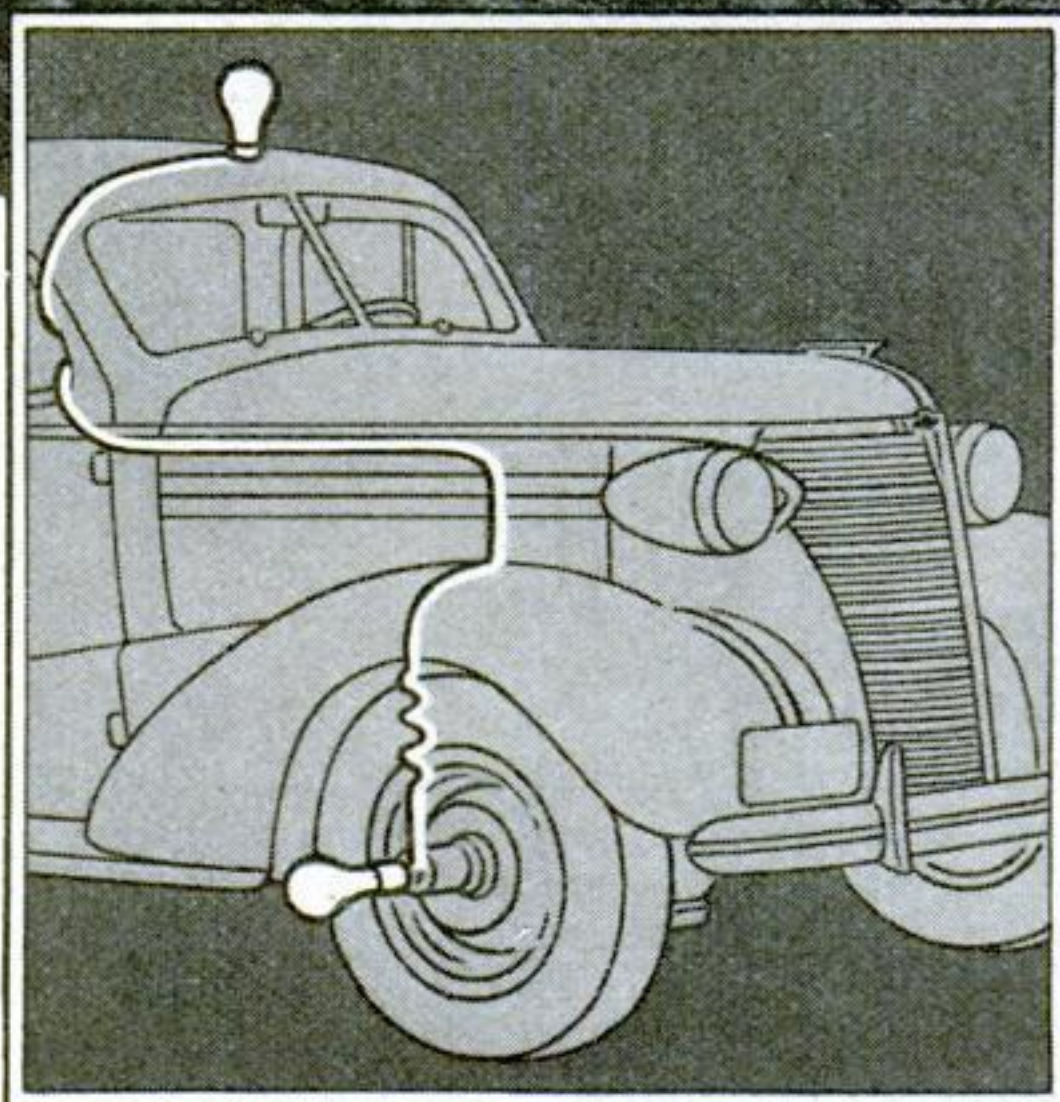
# Tracer Lights in Night Photo Show Level Knee-Action Ride



TO OBTAIN a visual record of the ride-leveling effects of individual front wheel suspension, or Knee-Action, Chevrolet engineers resorted to night photography, and made the car itself trace its ride diagrams on camera plates.

The tests were made at the proving ground, a Knee-Action Chevrolet being run at varying speeds over a specially constructed stretch of concrete paving having a washboard surface. To trace the indicator lines, two electric lights were used, one mounted on top of the body and the other attached to the end of the front wheel spindle.

To record the graph of the ride, the camera was placed well back from the track, far enough to include several car lengths in its field. As the car approached, the camera shutter was opened and held open while the car passed across the field of exposure. Positive prints of the negative show two lines of white on a



*Top—The upper line shows the body movement, the lower line the up-and-down movement of the front wheel, of a Knee-Action car on a washboard road. Bottom—Tracer lights are mounted on the roof and on the front wheel spindle.*

black background, one tracing the travel of the front wheel, the other showing the path followed by the body. The front wheel is shown to have followed the road surface closely, moving up and down at a high rate, while the car body was virtually unaffected by the bumps in the road.

The night photograph at the top of this page was obtained in the manner just described except that a flash bulb was set off as the car was about to leave the field of the camera, so that the car itself was photo-

graphed on the same plate with the previously recorded tracer lines.

By turning the illustration sidewise and sighting along the line made by the light on the body, one can note waves of far less amplitude and frequency than those made by the light on the wheel spindle. The diagram thus affords visual proof of the ride-leveling effects of Knee-Action.

*All Chevrolet Master De Luxe models have Knee-Action.*

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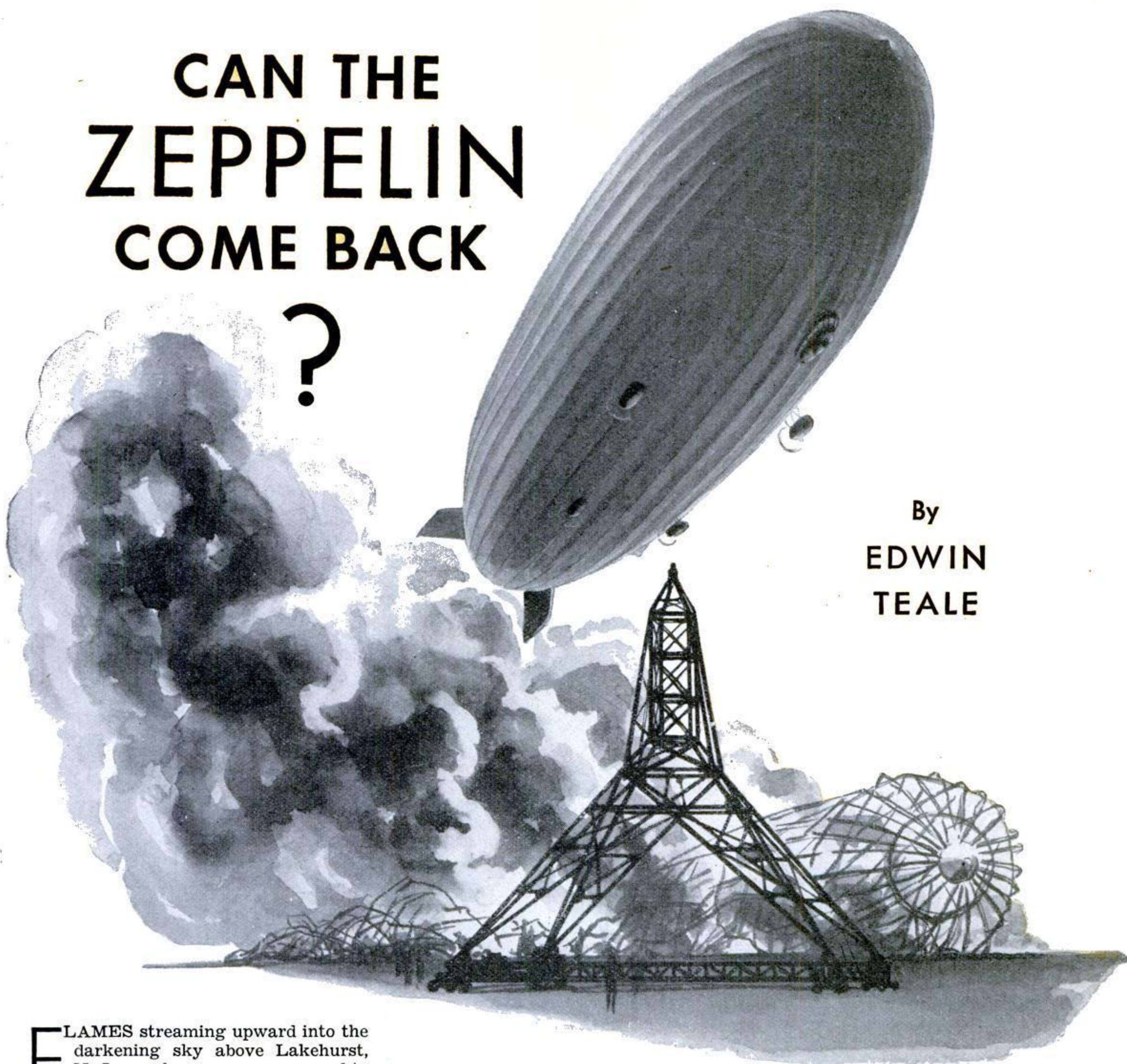
VOL. 132: NO. 4

RAYMOND J. BROWN, *Editor*

## CAN THE ZEPPELIN COME BACK

?

By  
EDWIN  
TEALE



**F**LAMES streaming upward into the darkening sky above Lakehurst, N. J., nearly a year ago, seemed to form a funeral pyre consuming the last hope of the rigid dirigible. The *Hindenburg* disaster, claiming thirty-six lives and destroying the largest and most luxurious skyliner ever built, was accepted by the world as bringing to a close the long and tragic story of the Zeppelin.

The ship had nosed down for the mooring. The radio operator had flashed word back to the German base: "All is well. Landing." An instant later, flames, starting mysteriously and fed by millions of cubic feet of inflammable hydrogen, were roaring the length of the

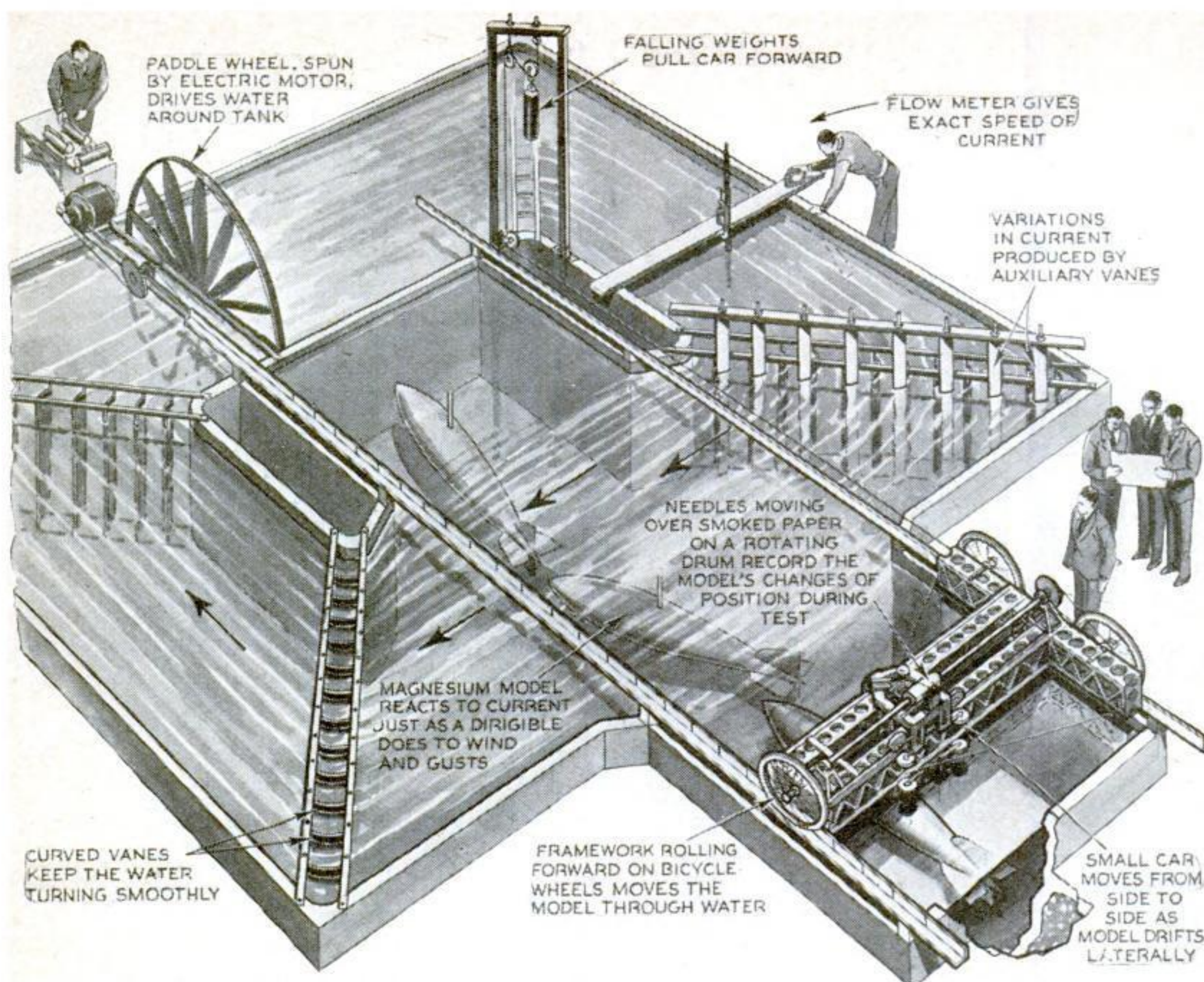
silver ship. Stunned by the catastrophe, most scientists agreed that "finis" had been written to the history of the sky leviathan.

Months have passed. In the great sheds at Friedrichshafen, on the Swiss-German border, another giant, the *LZ-130*, is being groomed for its initial tests. A few weeks hence, its four 1,200-horsepower Diesel engines will roar into action and the pointed nose of the great 800-foot dirigible will turn to the west for the 2½-day transatlantic crossing to Lakehurst. Once more, the Zeppelin is attempting a come-back.

As the new dirigible plows through the sky on its westward trip, it will leave behind 500 workmen busily engaged in the construction of a still larger ship, the biggest Zeppelin ever built. This monster, the *LZ-131*, will carry seventy passengers on each North Atlantic run. It gets its name from the fact that it is the 131st dirigible made by the Luftschiffbau Zeppelin, or Zeppelin Airship Construction Company, at Friedrichshafen. It is expected to be completed late in 1939.

While the Germans are preparing new skyliners for use on the long-dis-





Plan of the 20,000-gallon testing tank at Akron, Ohio, in which a metal dirigible model, submerged in water, reacts to currents simulating winds and air gusts encountered by an airship

tance airways of the world, American scientists are busy with scale models, imitation landing fields, swirling water, and trailing smoke. They are obtaining, in the laboratory, new information about the Zeppelin and its problems.

Akron, Ohio, is the scene of the most unusual of these experiments. Using a water tank instead of a wind tunnel, aeronautical experts at the Daniel Guggenheim Airship Institute are testing a curious "underwater dirigible." Machined from magnesium, the model is five feet long and about ten inches in diameter. It is so designed that it can be ballasted with water until it weighs exactly the same as the fluid it displaces. In this condition, it reacts to eddies and currents of water just as an airship, riding on an even keel in the sky, reacts to winds and gusts of air.

At one side of the 20,000-gallon tank, there is an eight-foot paddle wheel, formed of sixteen slim propeller blades. Spun by a direct-current electric motor, it drives the water in a clockwise direction around the thirty-four-foot tank. Curved fins at the corners keep the liquid flowing smoothly, instead of piling up and swirling around at the turns, and auxiliary vanes enable the experimenters to produce variations in the currents at will.

Imagine yourself witnessing one of the Akron tests. You descend to the basement of the laboratory at the municipal airport, where the scientists are busy adjusting the model, ballasting it so that it has no weight in the water. Lowered into the tank, it is attached to a vertical member carried by a small car which is free to roll along a framework of girders. This framework in turn, is mounted on three bicycle wheels so it

moves forward at right angles to the motion of the small car, pulled by a falling weight. Smoked paper is affixed to a recording drum at the top of the vertical member and two needles are set at the zero position. All is ready for the test.

In the meantime, the electric motor has been humming; the great paddle wheel driving the water on its circular course around the central well of the tank. An assistant, stationed at a flow meter, reports the speed of the current. During the tests, the rate of flow ranges from two to three inches a second. At a signal, the weight is released; the

bicycle-wheeled car rolls forward at a speed of about eight inches a second.

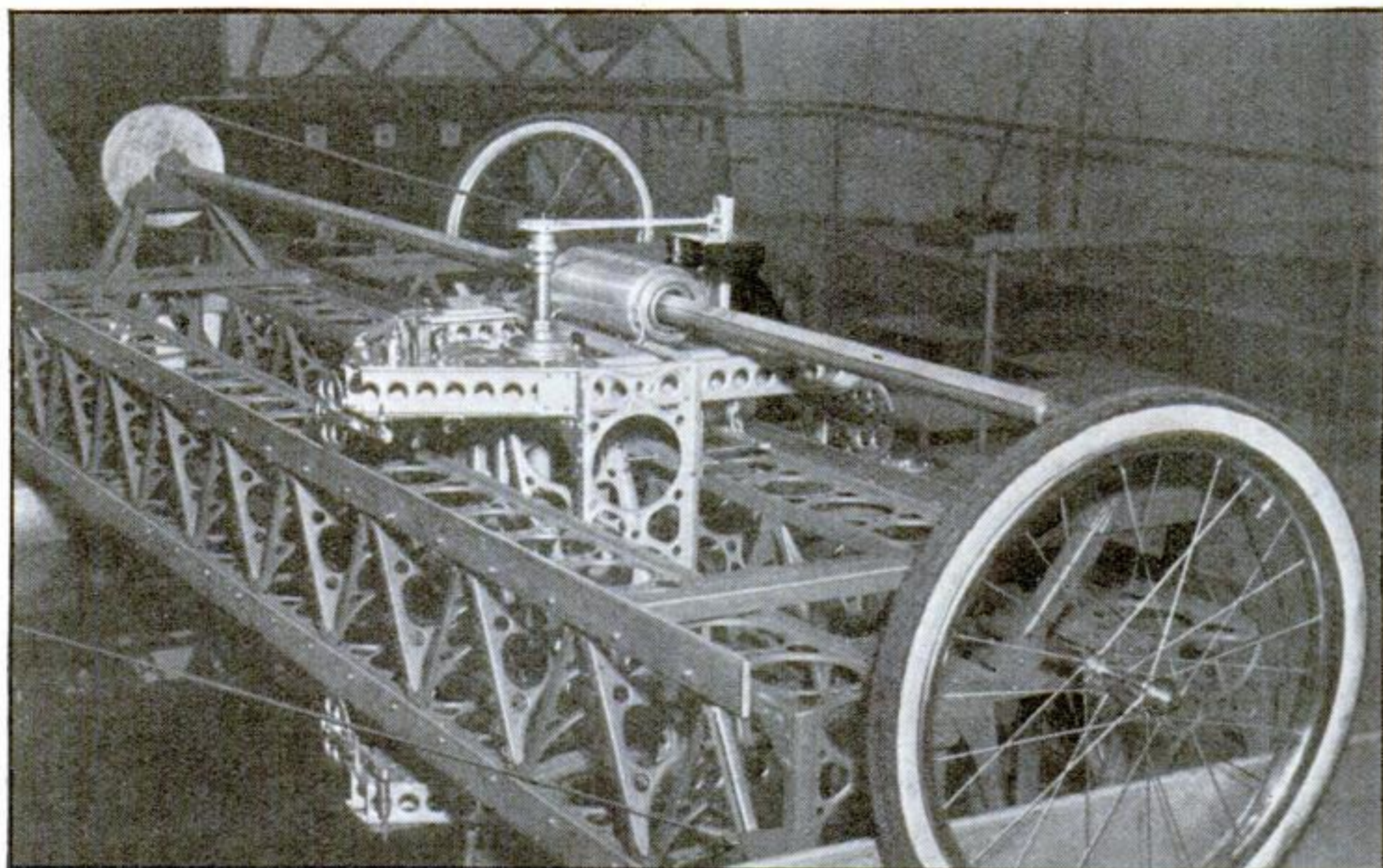
You lean forward to watch the cigar-shaped model cutting through the water. The current strikes it as it emerges from its "hangar" of calm water. The nose veers to the left. A moment later, the flowing water grips the whole model and moves it laterally in the same direction. Then, the nose enters the second "hangar" at the center of the tank and veers to the right as the current pushes against the tail. Finally, the model straightens out, "safe" in calm water after its journey of about twenty feet.

During that time, the two needles have been scrawling their zigzag record on the smoked paper. One line indicates the lateral movements, the other the twisting of the model. The relative speeds of water and model represent, when magnified to Zeppelin proportions, strain-producing conditions such as are met in high winds and gusty weather. The accumulating record sheets provide a basis for later calculations which will reveal much about the forces which act on an airship in flight and on the ground. The scientists at Akron are accumulating facts

of value to designers and navigators alike.

Another series of tests has been carried out at the great National Advisory Committee for Aeronautics wind tunnel at Langley Field, Va. Here, a twenty-foot model of the *Macon*, the U. S. Navy's ill-fated Zeppelin, was constructed of wood and finished so that the exterior reproduced the same type of surface as well-doped fabric. This dummy dirigible was supported above a floor of wood, constructed across the center of the tunnel to represent the landing field.

While smoke, generated by pouring



This is the rolling carriage that propels the model as it traverses the tank. The motions of the miniature Zeppelin are recorded on smoked paper on the cylinder seen in the center



# AS THE SUCCESSOR TO THE ILL-FATED "HINDENBURG" TAKES THE AIR, SCIENCE PONDERES THE FUTURE OF LIGHTER-THAN-AIR CRAFT

kerosene on heated coils, streamed down the tunnel, a sixteen-millimeter moving-picture camera recorded the way it swirled around the hull of the model when it was placed at different angles in the slip stream. Almost every condition an airship meets in coming to ground and being maneuvered about by a landing crew, can be reproduced in miniature by this method. Rolling, pitching, yawing, as well as meeting head winds, tail winds, and cross winds, have been investigated by the men at Langley Field.

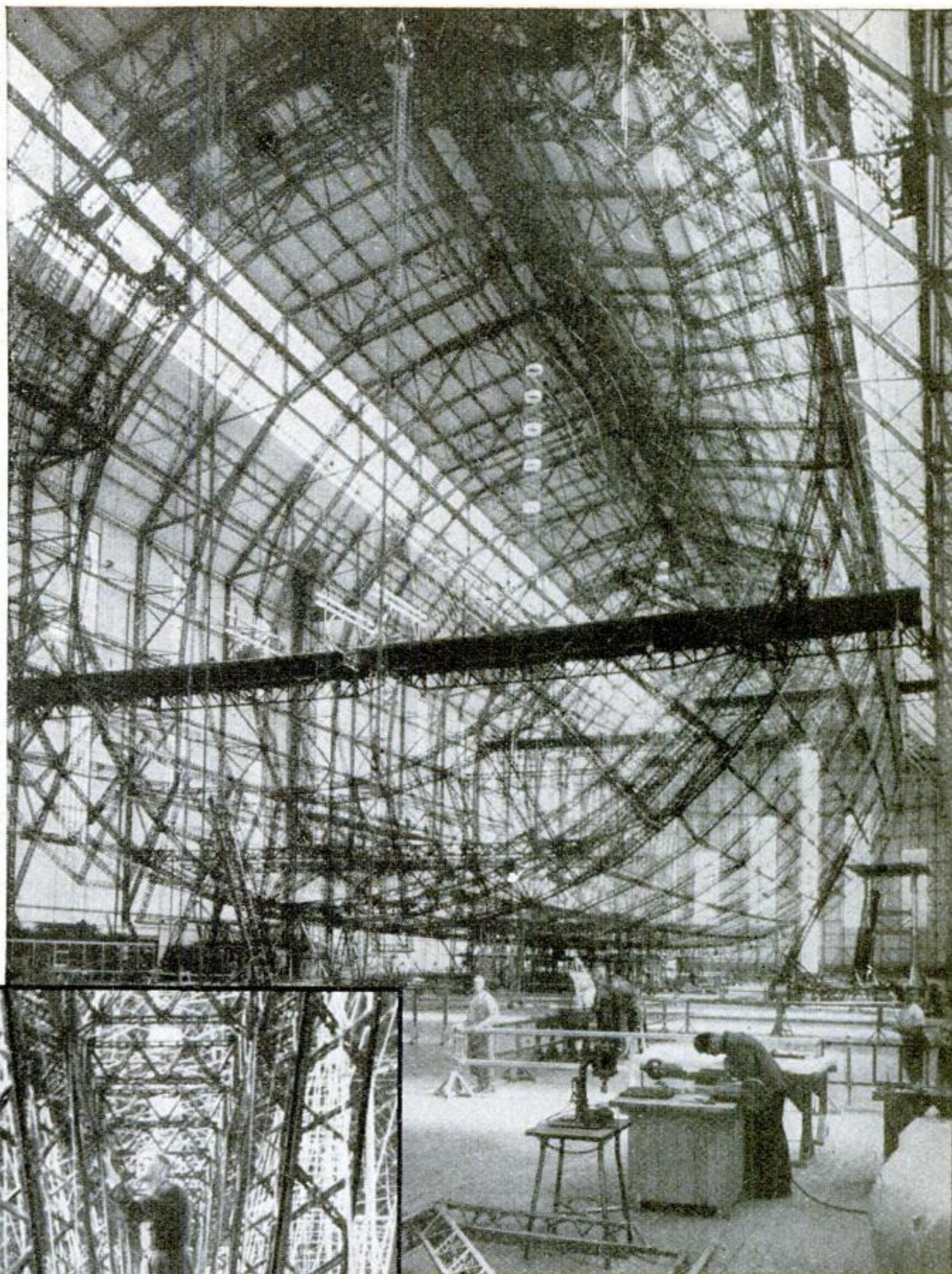
Thus, in spite of the reverses of the past, scientists, both here and abroad, are busy with the problems of the rigid airship. The long dream of flying hotels and globe-circling leviathans continues to urge the experimenter on.

The whole story of the Zeppelin has been one of great promises which have fallen short of fulfillment.

One hundred and fifty times, engineers have constructed and tested these aerial giants. The Zeppelin works, at Friedrichshafen, alone, has turned out 130 in its forty years of activity. One by one, the great lighter-than-air craft have been wrecked by structural defects, torn from the hands of inexperienced landing crews, brought down in flames by wartime shells, broken by storms.

In America, the history of the Zeppelin has been short and disastrous. Above the cornfields of Ohio, a line squall broke the back of the *Shenandoah*; off Barnegat Lightship, the *Akron* plunged into the Atlantic; thirteen miles west of the jutting rocks of Point Sur, Calif., the *Macon* crashed and sank. Only the superannuated *Los Angeles* remains, out of commission, in a hangar at Lakehurst.

Equally ill-starred have been the English Zeppelins. The last of the

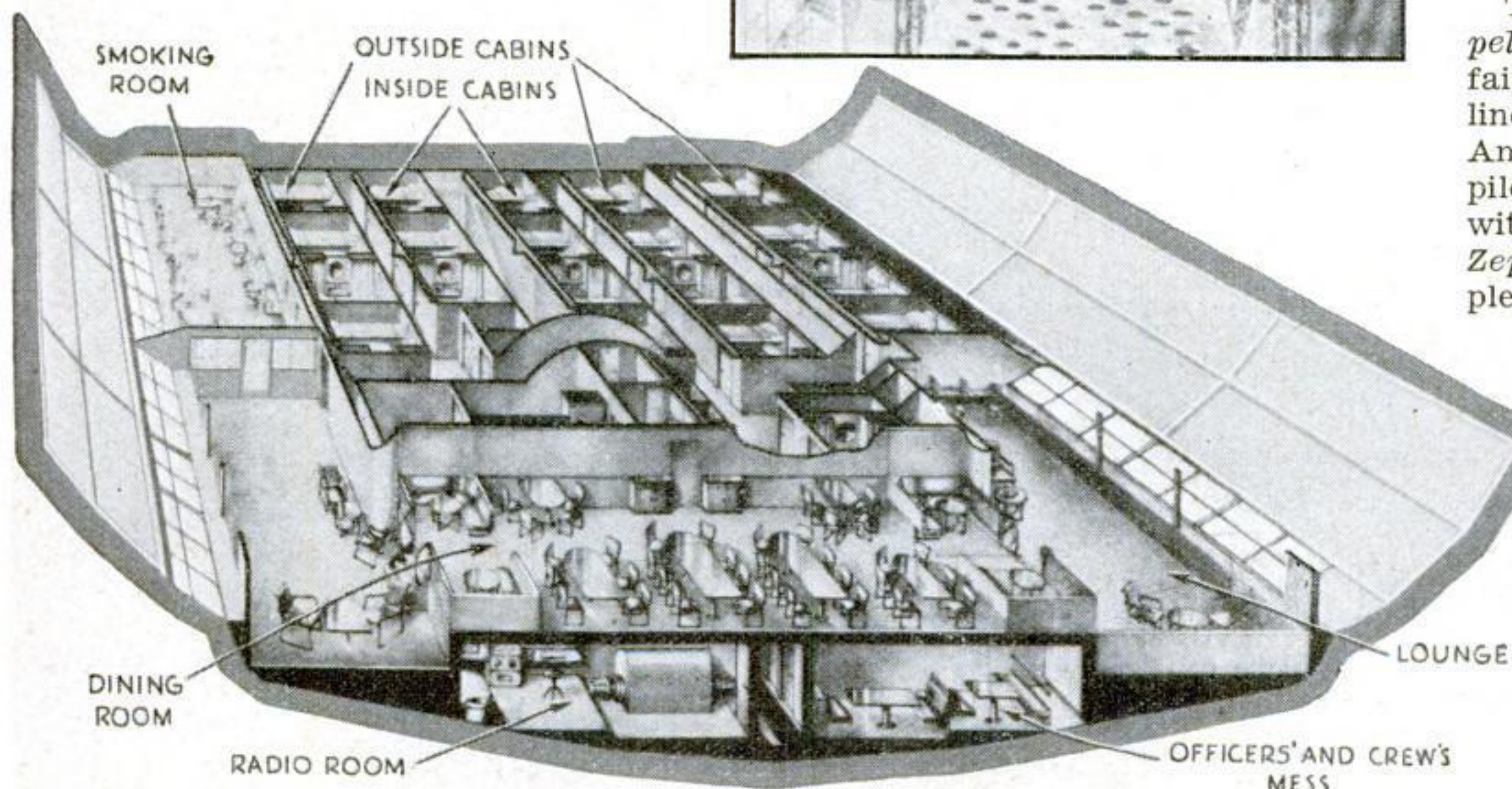


The skeleton of Germany's new LZ-130 taking shape in the Zeppelin airship works at Friedrichshafen. At the left is the catwalk through the hull and, below, an artist's sketch of the passengers' quarters.

line was the palatial *R-101*, designed for service between India and England. Nosing through low-lying fog on its first flight in 1930, it crashed into a hillside fifty miles from Paris, France, exploded and burned. All except seven of its fifty-six passengers perished.

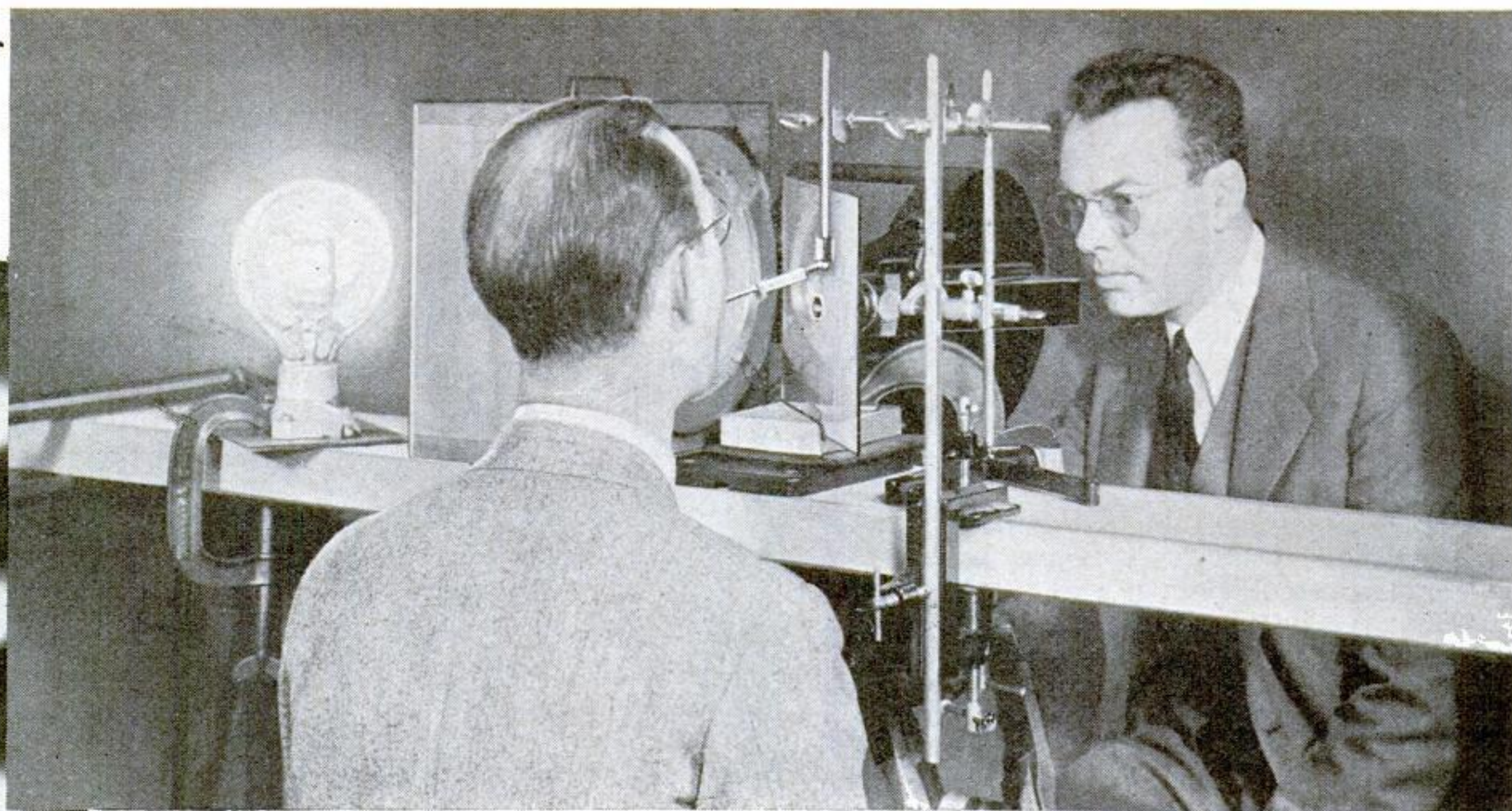
The Germans, with their *Graf Zeppelin* and *Hindenburg*, retained their faith in the flying cigars. These two skyliners shuttled back and forth to South America and the United States. They piled up hundreds of thousands of miles without a serious accident. The *Graf Zeppelin* even circled the globe. Completing ten trips across the Atlantic in 1936, the *Hindenburg* for the first time in history proved that the rigid dirigible could be commercially profitable.

This was the situation on the sixth of May, 1937. Then, at twenty-three minutes past seven in the evening, disaster struck at Lakehurst. Around the world, people asked the same question: Did the accident represent a temporary *(Continued on page 118)*





A Bell Laboratories engineer making motion pictures of a subject's vocal cords with a special camera



## ODD LABORATORY TESTS SHOW US How We Speak

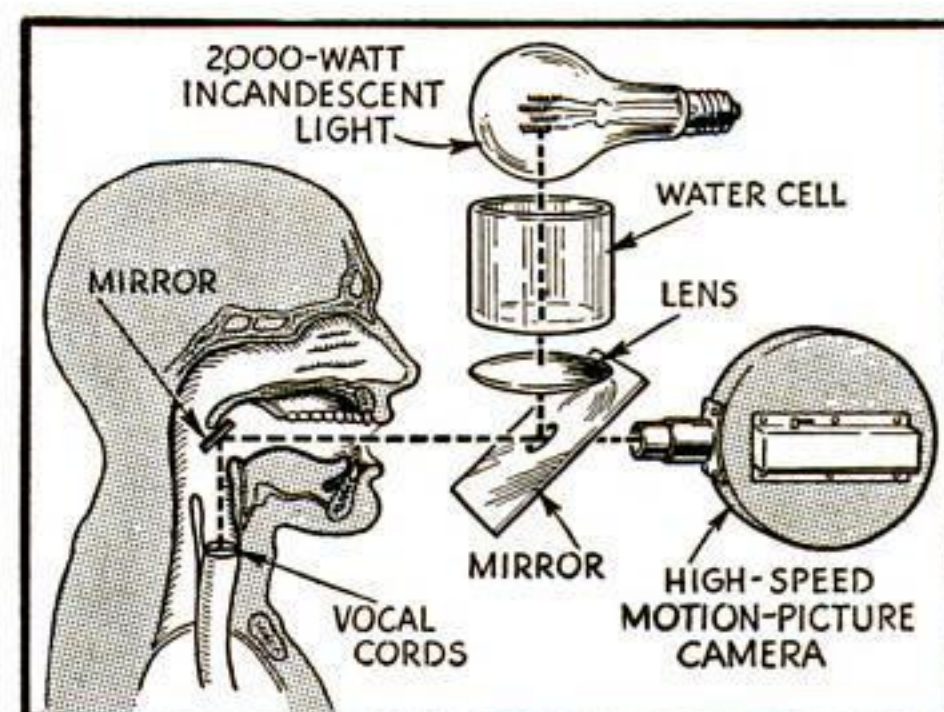
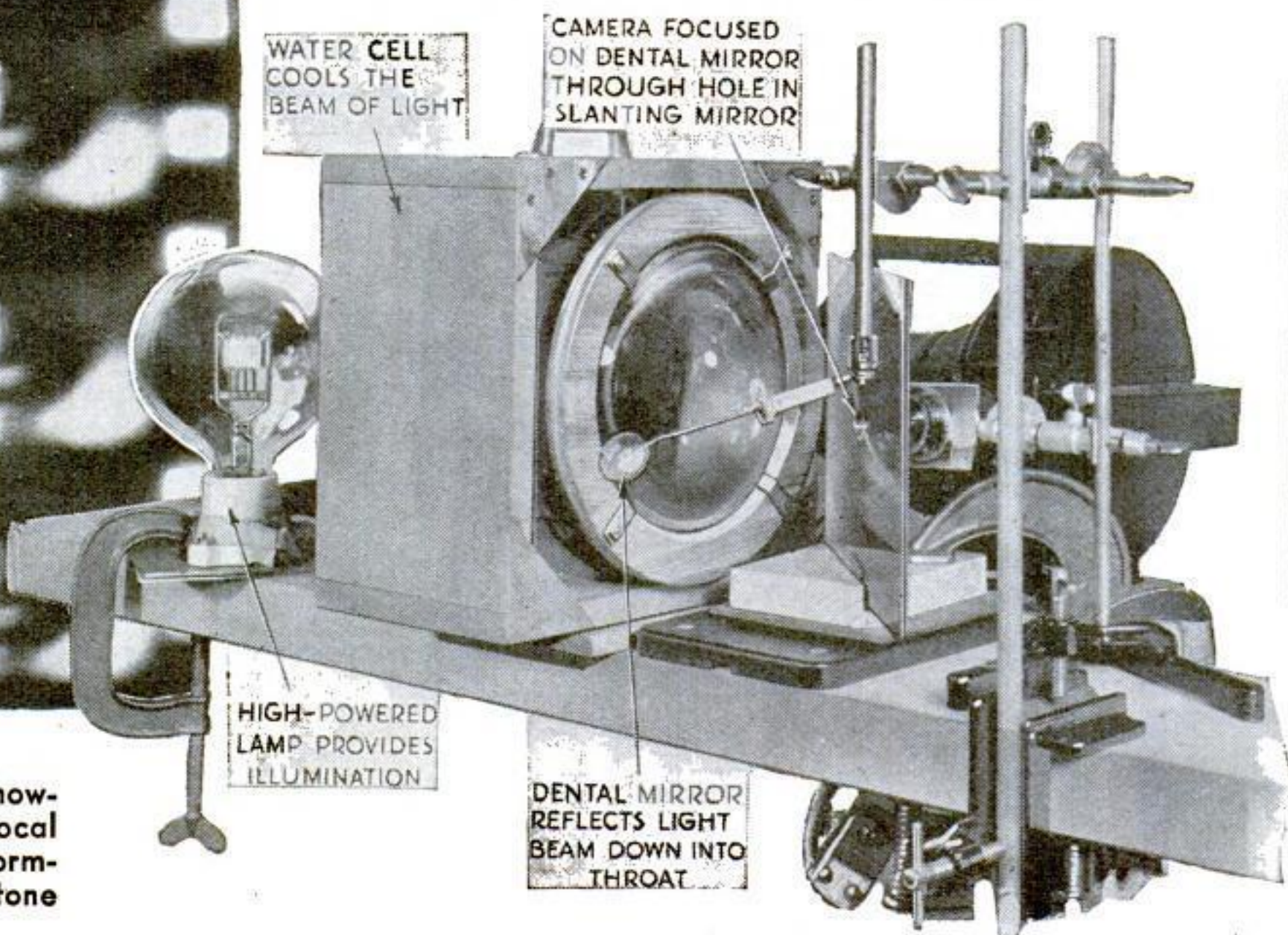
**T**AKING movies of human vocal cords at the rate of 4,000 pictures a second, an ultra-high-speed camera developed by Bell Telephone Laboratories engineers is helping to solve the age-old mystery of how we speak and sing. When its pictures are projected on a screen at the normal rate of only sixteen to twenty-five frames a second, lightning-fast movements of the tiny membranes that give us our speech are slowed down so that their true action is revealed.

To do this, the subject sits before a 2,000-watt incandescent lamp, overloaded with electric voltage to give it dazzling brilliance. A vessel of water absorbs the burning heat of the light, which a condensing lens narrows to a parallel beam. Then a large inclined mirror directs the illumination into the subject's mouth, where a small dental mirror throws the beam down his throat. While the subject intones a syllable like "ah," his vibrating vo-

cal cords reflect the light back to the dental mirror and through a hole in the large mirror to the camera lens.

Besides serving its primary purpose of assisting in the development of telephone and radio equipment that will respond more perfectly to the human voice, the new camera yields vital clues to the secret of our speech. It is the latest addition to an array of modern scientific tools with which a little band of research workers has found out more about our speaking mechanism in the last few years than earlier experimenters had done in centuries. Better systems of voice training for actors, speakers, and singers, and greater enjoyment for their audiences, are among the promises of these surprising new discoveries.

That your vocal cords work like a fire-engine siren—and not like a violin, as was widely believed by singing teachers and scientists alike—has just been established by



### FILMING THE HUMAN VOICE

At the left is the ultra-high-speed motion-picture camera that photographs the vocal cords in action and "slows down" their movements for study. The drawing above illustrates how the apparatus is arranged for making the movies

Movie strip showing how the vocal cords act in forming a single tone



Girl college students making phonograph records of their voices for corrective study



Dr. Jack C. Cotton, of Ohio State University. His findings end a controversy that has raged for two centuries or more over the behavior of the sound-producing pair of membranes stretched across your respiratory passage just behind your Adam's apple, like twin doors in a circular tunnel. The French scientist Ferrein, who in 1741 conferred the misnomer of "vocal cords" upon these folds of membrane, thought of them as vibrating strings bowed by the air stream of the breath. Even to this day, his view has been accepted without challenge by many authorities.

Now it turns out that the vocal cords—or "vocal lips," as Dr. Cotton prefers to call them—act simply as air valves. Delicate instruments for the study of rapid motions show that the membranes open and close in the brief space of one five-hundredth of a second, emitting a swift succession of tiny, explosive puffs of breath. An audible sound results, with a pitch that depends upon the number of puffs to the second—just as in the case of a mechanical siren that passes air through two disks pierced with holes, one fixed and one revolving, to release similar puffs. Thus is produced the basic tone that you can hear in pure form when you hum, and that your tongue and lips modulate, or transform into words, when you speak or sing.

The new picture of the human voice as an instrument like a siren explains satisfactorily, for the first time, how anything as small as vocal cords less than an inch long can call hogs or fill a concert hall. Tones from vibrating strings of this size would be so weak that they would have to be amplified in

some fashion before reaching the lips. One suggestion was that hard surfaces like the roof of the mouth act as sounding boards for the voice. Unfortunately for this theory, well-known scientific laws make it possible to calculate that the roof of a baritone's mouth, to respond to the fundamental tone of his high C, would have to be more than four feet long!

Singing teachers have cherished the more plausible assumption that the human voice is amplified, and its tonal quality improved as well, in the so-called "resonating chambers" afforded by the nasal passages of the head. Their pet theory received a rude shock when Lucrezia Bori, famous soprano, and other singing celebrities submitted to X-ray tests conducted by Prof. G. Oscar Russell of Ohio State University. High-speed X-ray pictures, taken while they were singing, revealed that they rarely opened the connecting passage from the mouth into these supposedly important air chambers. Further tests show that the nasal passages actually muffle the voice instead of amplifying it, and might better be called "sound filters" or "sound modulators" than "resonators." They help pronounce words containing "m," "n," and "ng," and their soft linings may absorb some of the harsher,



Al Siegal, Hollywood vocal coach, showing Claire Dodd how to use the resonoscope, an instrument which he used in raising the actress' voice a whole octave in pitch

high-pitched tones, but their effect upon both the loudness and the general tone quality of the human voice appears much less than has been supposed. Bad qualities like strident and falsetto tones, good qualities that singers try to cultivate, and the elusive individual "timbre" that distinguishes your voice from someone else's, all seem to depend primarily upon the delicate muscles that control the vocal cords and the part of the throat immediately above them.

New knowledge about the voice calls for new training methods, and modern scientific aids are now available to help

students. By producing wavy patterns of light upon the window of a cathode-ray tube, a device called a resonoscope enables a singer to check his trueness of pitch and also to observe his tone quality or timbre. With this electrical instrument, a Hollywood voice expert succeeded in raising the voice range of Claire Dodd, screen actress, a whole octave. Radio announcers and singers are also being coached with the aid of an in-



strument called an "auto-phonoscope," consisting of a maze of mirrors and lenses set in an angular tube and placed far back in the student's mouth. By watching what happens in the subject's throat while he talks, the teacher can correct muscular mistakes with great certainty. The pupil can see, too, thus aiding his own understanding of his vocal processes.

## Using X Rays, Fast Movie Cameras, and Cathode-Ray Tubes, Scientists Are Learning New Facts About the Human Voice and Developing Teaching Methods To Make Us Better Talkers

By JOHN E. LODGE





## Marionettes Act Out Radio Opera

SO THAT invalid children in St. Vincent's Hospital in New York City could "see" as well as hear a radio broadcast of the opera "The Barber of Seville," a marionette show simulating the actions and the scenery of the original opera was performed within the hospital. Miniature marionette models of the opera stars were dressed in tiny clothes fashioned after the actual costumes. As the songs and dialogue came in over the radio, operators above the stage synchronized the action of the marionettes with the words and music of the opera, as pictured at the left.



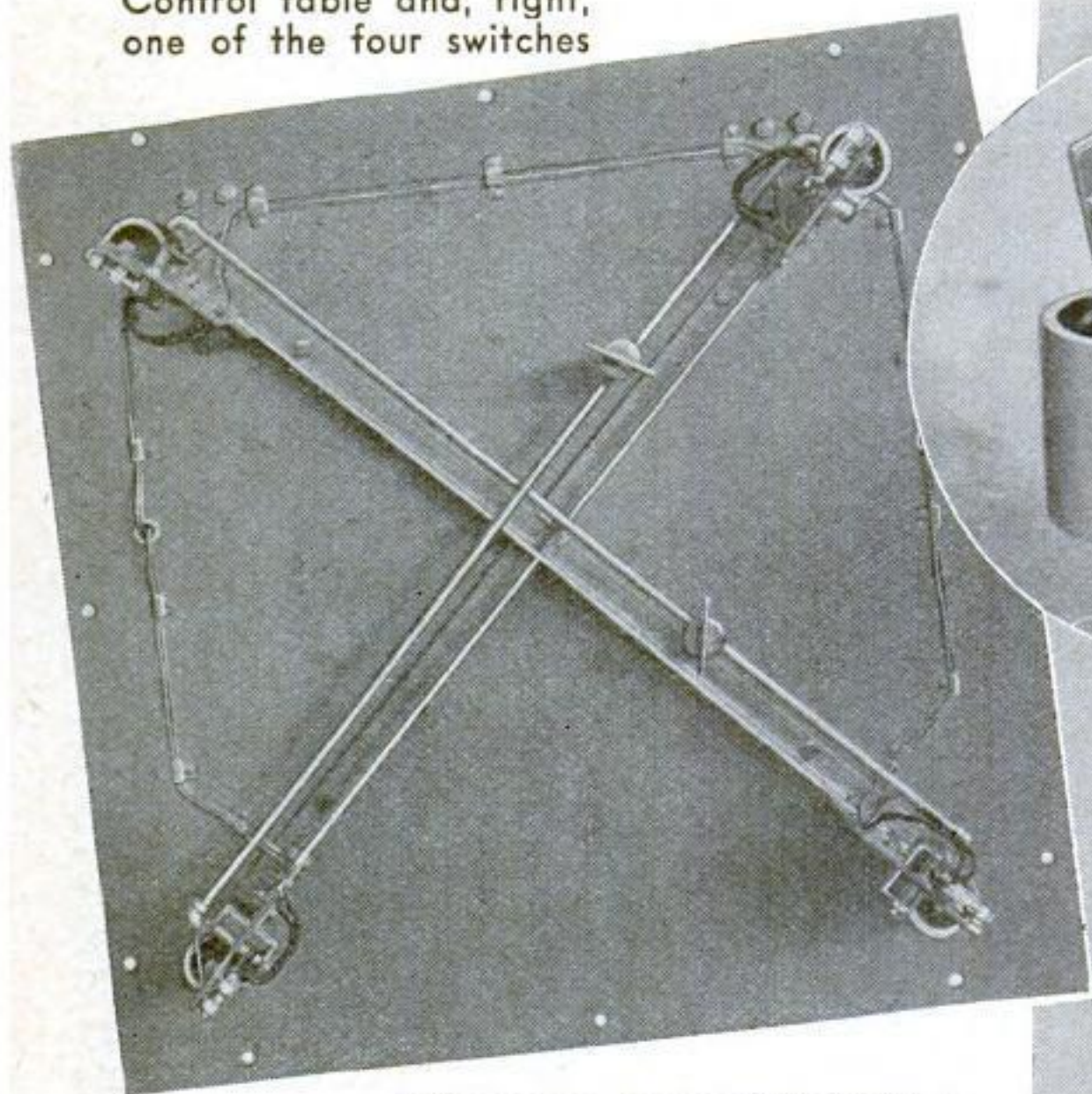
## Gems Made of Fish Eyes

AFTER experimenting for three years, Gustav Bohland, a Miami Beach, Fla., sculptor, has perfected a chemical process for turning the crystalline lenses of the eyes of fish into hard, brilliant, pearllike gems. In the photograph above, he is exhibiting one of his unusual products.

Operators putting a puppet prima donna through a difficult aria

## Tiny Mercury Switches Level Giant Electric Shovel

Control table and, right, one of the four switches



When the horizontal table is tilted, a switch makes contact to start up the leveling jacks

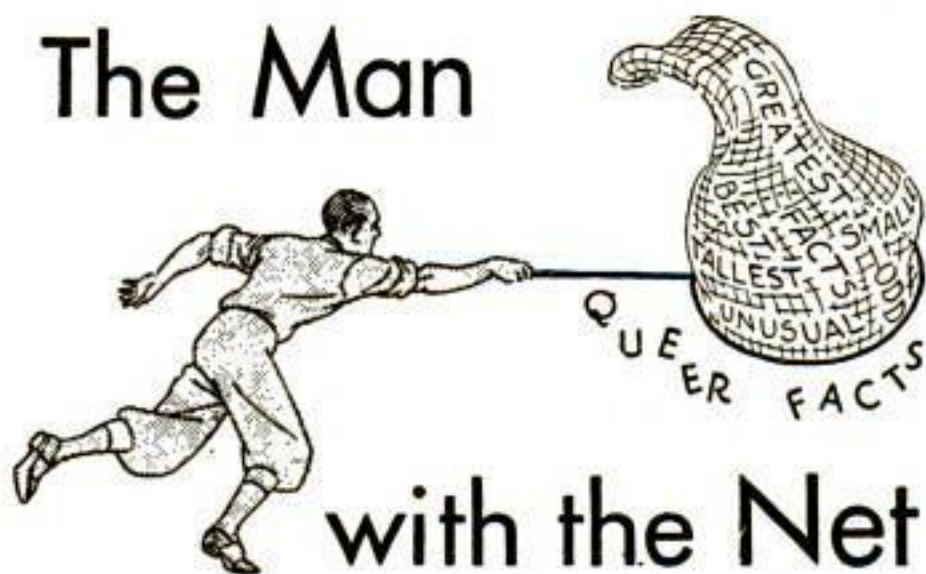
**T**OWERING over 100 feet in the air, the largest electric shovel in the world, now in use for strip-mining operations in Missouri, is maintained on an even keel with the aid of four tiny mercury switches mounted at the corners of a small plane table. After the giant shovel hauls itself from one location to another on its four endless-tread tractor units, it tends to settle unevenly into the new footing on which it rests. When this happens, mercury flows from one end of a switch tube to the other, closing an electric circuit and starting the operation of powerful hydraulic jacks to level the mammoth coal stripper.



Four endless-tread tractor units support this 2,500,000-pound strip-mining machine



## The Man



with the Net

**SPERM WHALES** can eat a ton of food a piece in one day.

**WALL PAPER** made of glass cloth is now available for interior decorating.

TRY'N COVER THAT SPOT WITH GLASS WALL PAPER!



**ONE** out of every ten persons in the United States lives in the State of New York.

**COAL** in thin sheets has been used for window glass at an exhibit in the Field Museum, in Chicago, Ill.

**CROW MEAT** is now canned and sold for food by a midwestern firm.



**ICE HOUSES** coated with aluminum paint reflect more of the summer sun's rays and so preserve the ice better than those finished in darker colors.

**GOLD SALTS** are being used for the treatment of arthritis.

**SNAKES** have only one lung.

**SINCE 1890**, the United States center of population has been in Indiana.



**WARM WATER** flows in a steady current beneath the north pole.

**WOMEN** have a better chance of recovering from insanity than men.

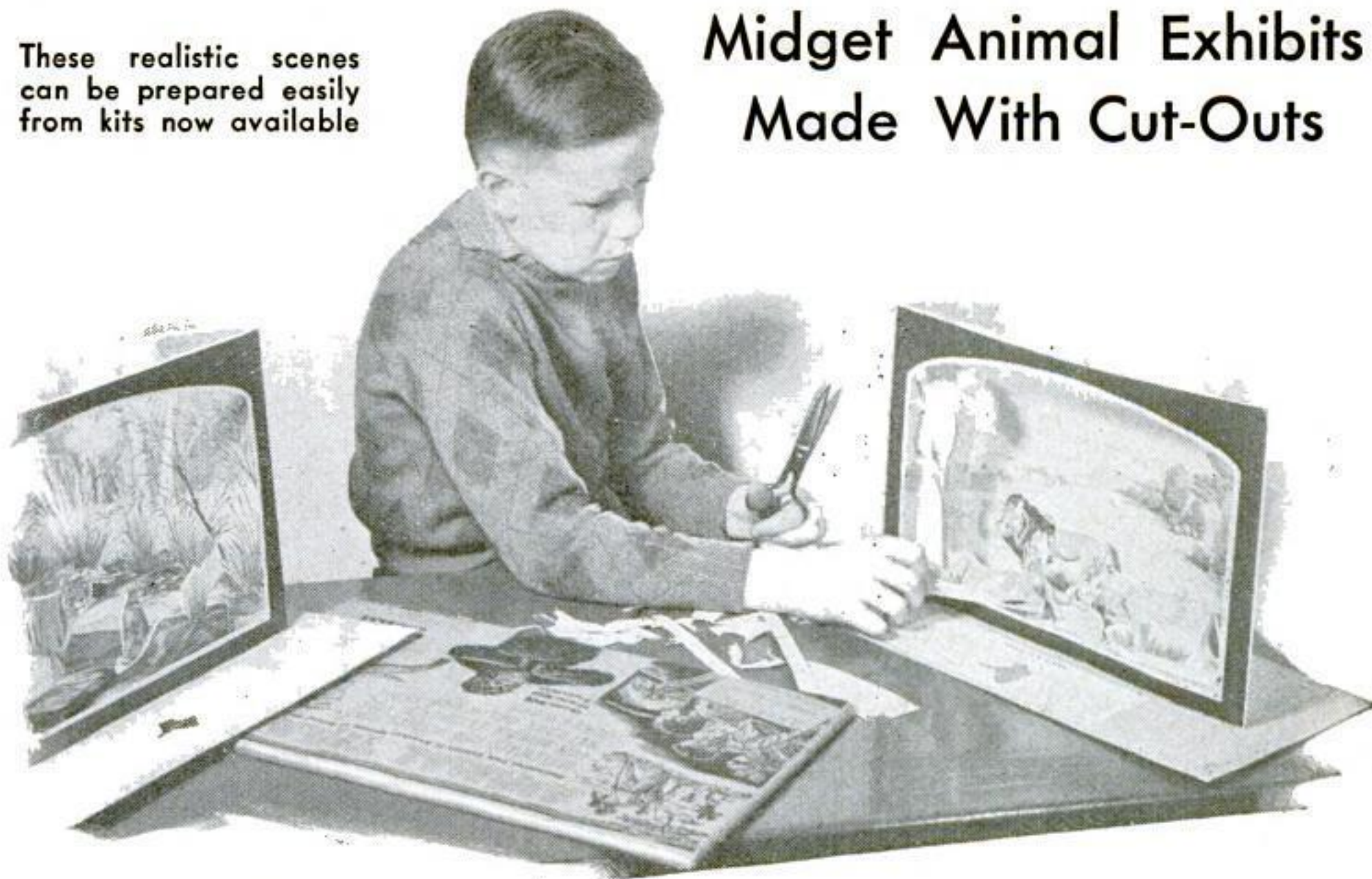
**MAN** could continue to live on earth only nine more years, it has been estimated, if all the birds in the world were exterminated.

**LIONS**, if they had tongues proportionately as long as those of snails, could lick objects twenty feet away.



These realistic scenes can be prepared easily from kits now available

## Midget Animal Exhibits Made With Cut-Outs



**MINIATURE** reproductions of the famous animal exhibits in the American Museum of Natural History, New York City, can be made with novel cut-out kits now on the market. A pair

of scissors is the only tool needed to fashion the displays, which are packed four to a box and provided with wire clips for fastening the various parts after they have been cut out.



Experts studying the placing of instruments in a dummy plane cabin

## Dummy Cockpit Aids Designers

**COMPLETE** in all its details, a dummy model of the cockpit and instrument panel of a four-engine airliner now under construction was used by test engineers to check the arrangement of instruments and controls for convenience, simplicity, and ease of operation. Gyroscopic instruments in the finished plane will be in triplicate, others in duplicate.

## Student Discovers New Explosive

**SAID** to be fifty-three times more powerful than T.N.T., a new type of explosive was discovered recently by Wendell Zimmerman, graduate student at the University of California. Now known only as "RPX," the explosive was first announced for use in rocket experiments. Zimmerman is pictured at work in his laboratory in the photograph at the right.

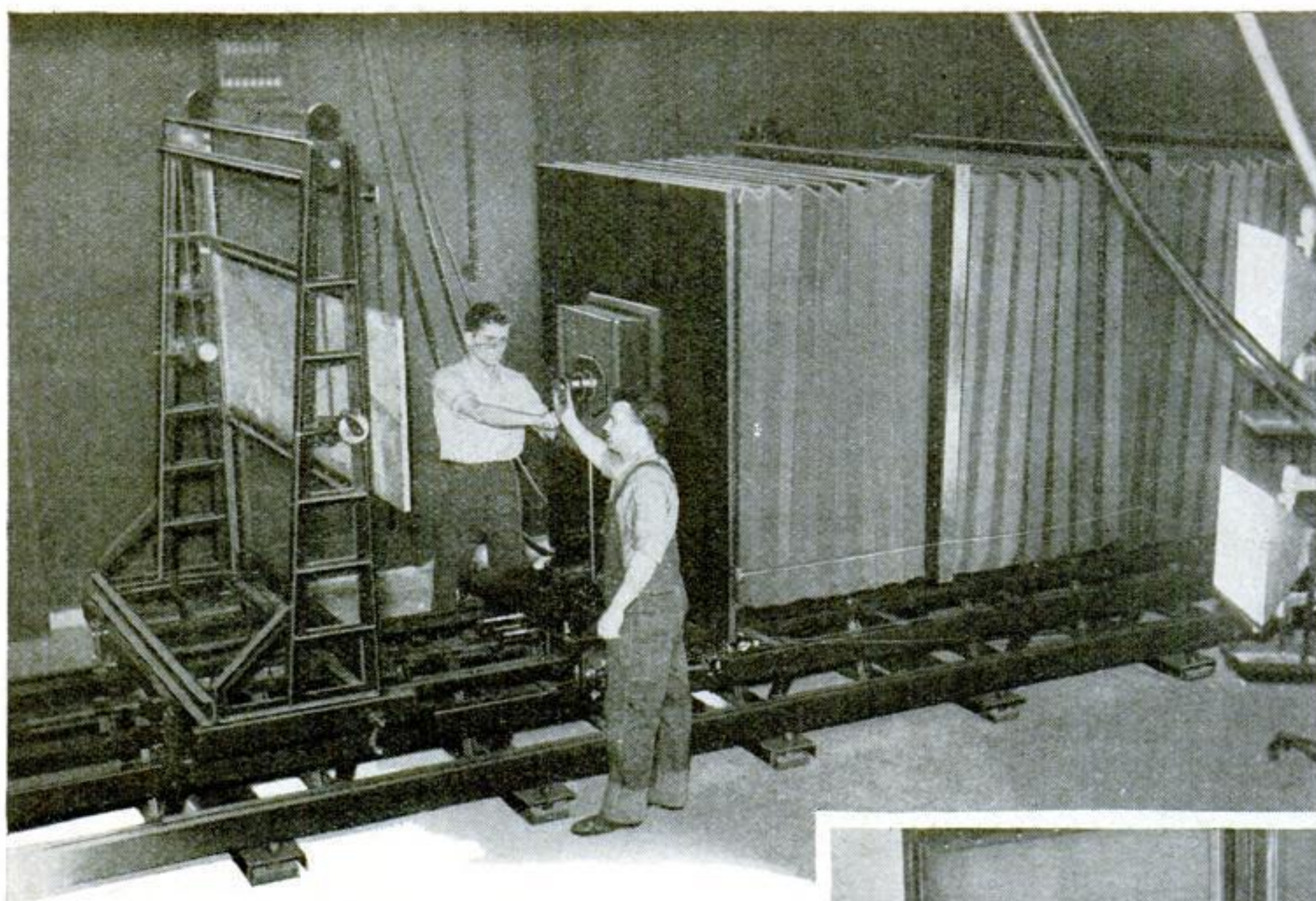


Wendell Zimmerman. His explosive excels T.N.T.

## Can Fish Talk?

**FISH** may have a language all their own, according to Baron Karl von Frisch, German zoölogist. He observed that small fish often make faint, piping sounds when excited, and that goldfish are particularly responsive to certain man-made sounds.





Workmen focusing the giant camera on its copying easel. An electric motor extends the bellows along a wide track



This is the special developing tank for the five-foot-square plates. At left, an operator is examining an image on the huge ground-glass focusing screen

## Mammoth Camera Uses Five-Foot Plates

ONE of the largest of its kind in the world, a copying camera in use in Cleveland, Ohio, for color-printing work has a bellows that is more than five feet square and can be drawn out to a maximum length of twenty feet. Built at a total cost of approximately \$25,000, the photographic giant was too large to fit into one room of the plant in which it was recently installed. The bellows and copying easel were therefore placed in one room and the ground-glass focusing screen in an adjoining one. Employing a lens that measures eight

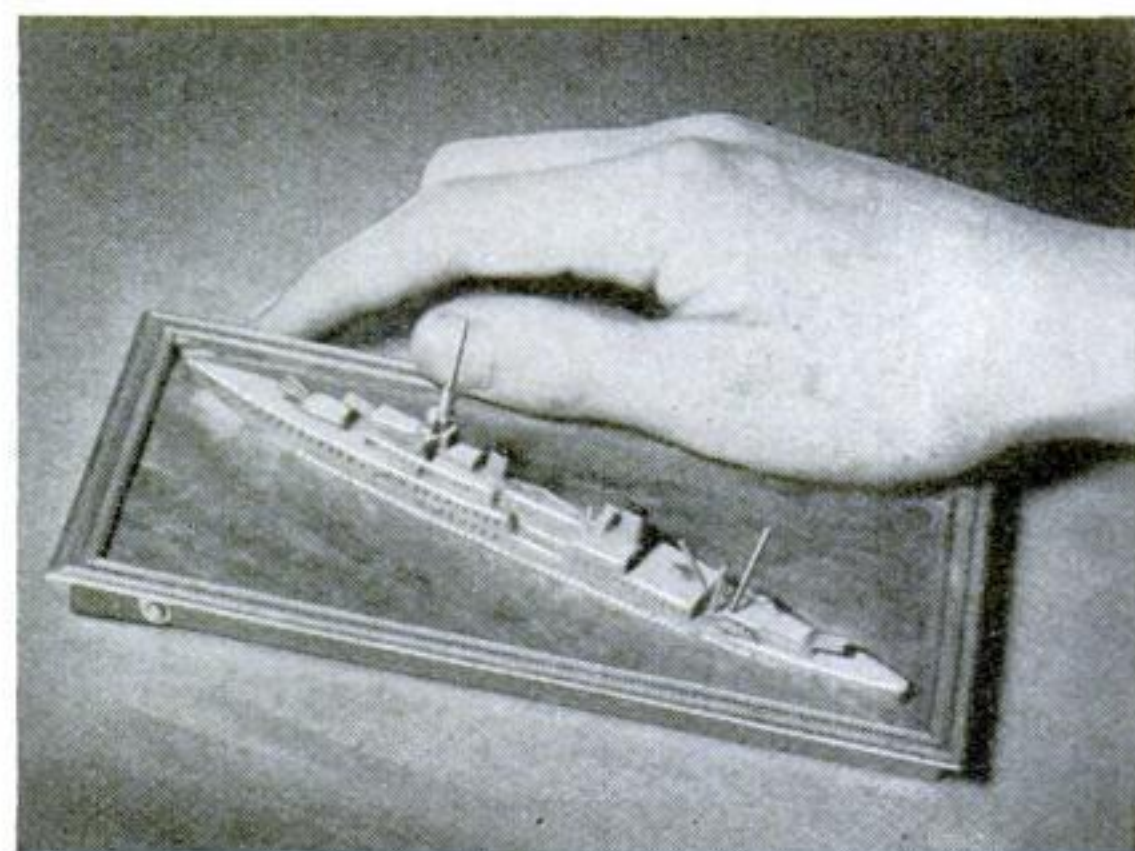


inches in length and weighs twenty-five pounds, the camera is focused with the aid of an electric motor which extends or contracts the bellows. The latter rolls along rails that are spaced wider than those of a standard-gauge railroad. Photographic plates up to a size of

about five feet square can be accommodated in the mammoth camera. After exposure, these plates are developed in a specially built tank that is rocked back and forth by a hand-operated crank to insure uniform development of the negative over its entire surface. Some idea of the gigantic proportions of the apparatus may be gained by comparing it with the men who are adjusting its lens in the photograph reproduced above.

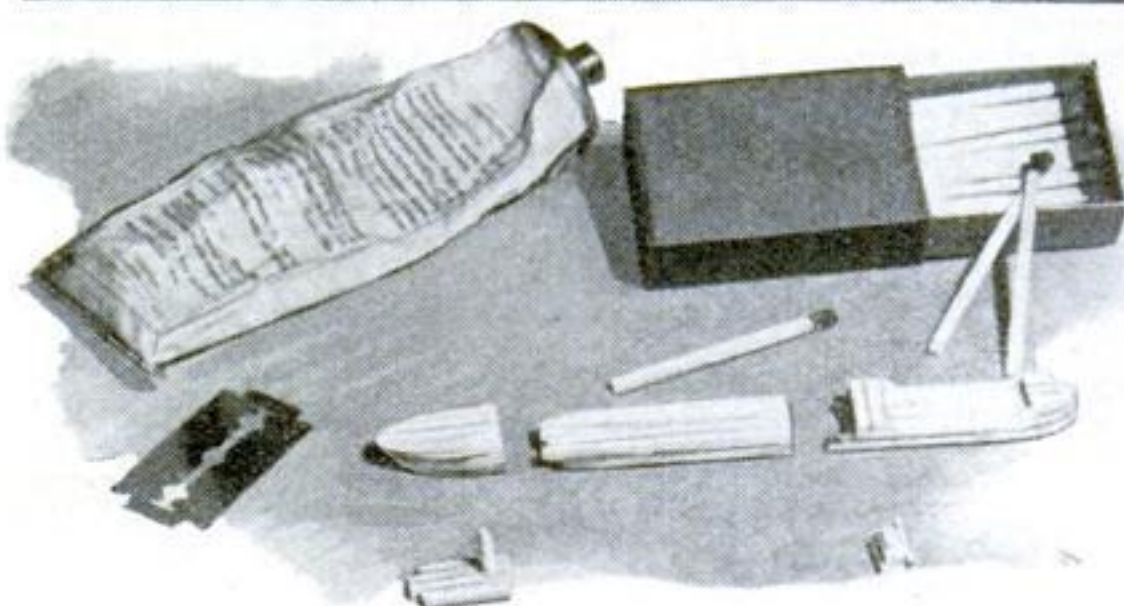
## Midget Ship Models Made from Match Sticks

MAKING ship models from match sticks and common pins is the novel hobby of Roger D. Smith, of Yonkers, N. Y. Scaled down from POPULAR SCIENCE MONTHLY blueprints, the match model shown in completed form at the right, was constructed with simple equipment that included a razor blade, cement, sandpaper, and a pair of small forceps. Smith scales his models so that the thickness of one match represents one deck.



## Slot Machine Pops Popcorn to Order

POPCORN is popped to order by a novel vending machine just invented. When a coin is placed in the slot, corn drops into a transparent popping chamber where blasts of hot air cook it in one minute. Turning a knob butters and salts the popcorn, which then pours from a spout into a paper bag.



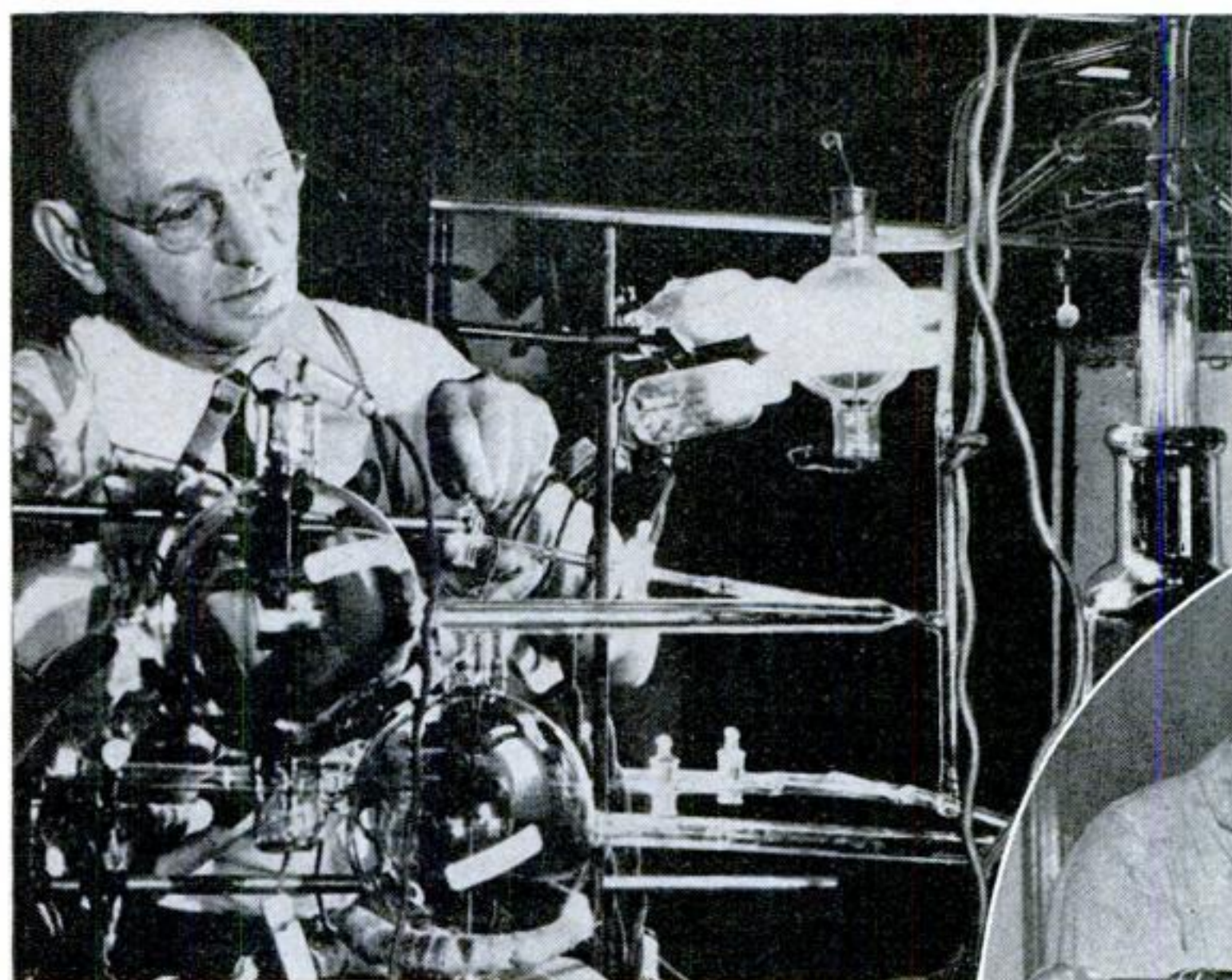
Model of U.S.S. "Indianapolis" made by Roger D. Smith, of Yonkers, N. Y., and building materials used



Freshly popped corn pours out into a bag



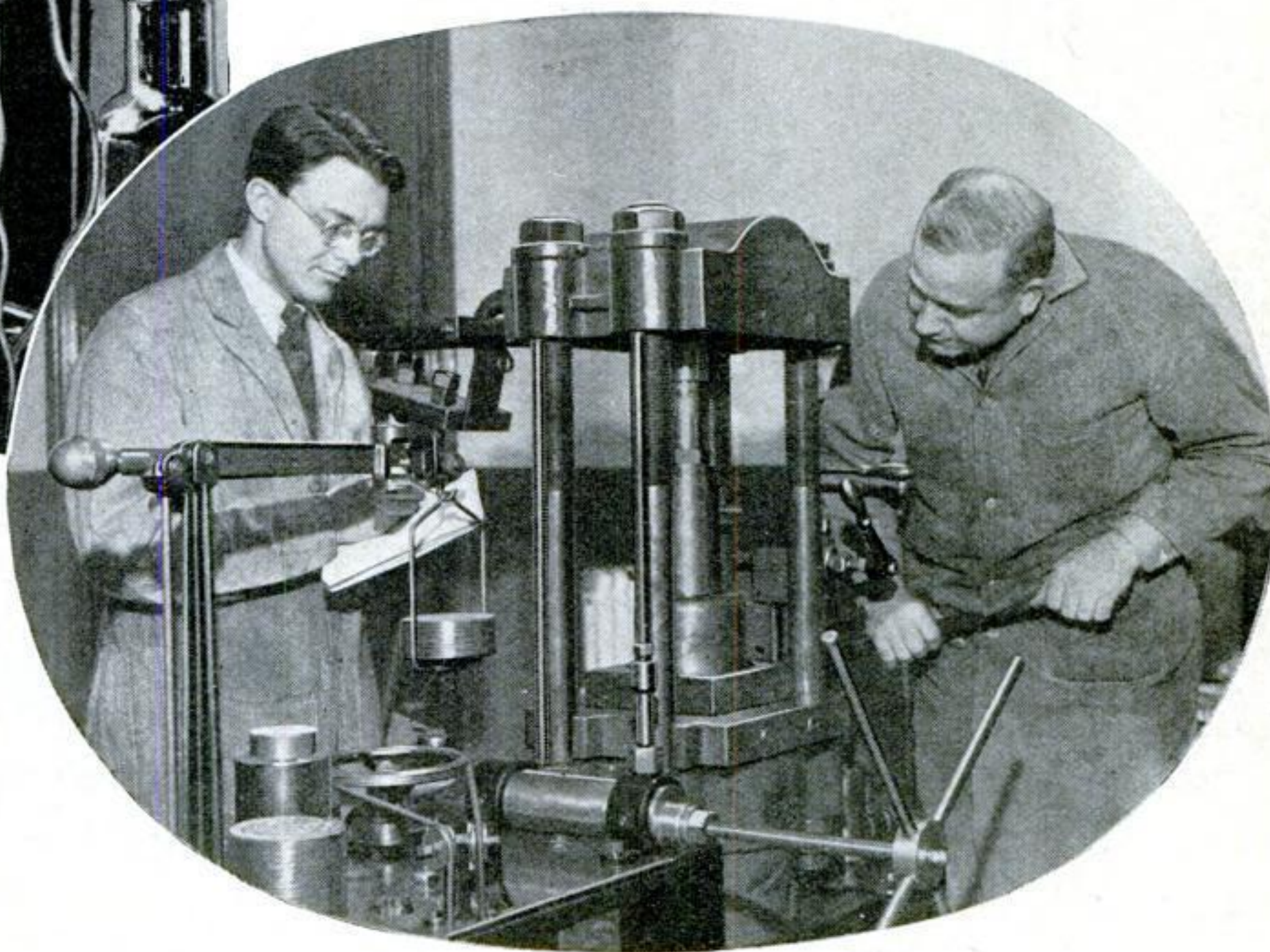
# Scientists Produce Maximum Pressure and Vacuum



William A. Ruggles, of Schenectady, N. Y., with the outfit used to create the highest known vacuum

**WORKING** at opposite ends of the air-pressure scale, scientists in two American laboratories have succeeded in creating what are believed to be the greatest air pressure and the highest vacuum ever produced. At the Armour Institute of Technology, in Chicago, Ill., Dr. Thomas Poulter, director of research, and his assistant, Robert Williams, have developed equipment capable of producing the astounding pressure of 1,500,000 pounds to the square inch. Their efforts are expected to open up many new fields of scientific research, including new studies

of the characteristics of the energy trapped within the interior of the atom. At Schenectady, N. Y., William A. Ruggles has been working in the General Electric Research Laboratory for a period of twenty-five years to create a perfect vacuum within a glass tube. Although his efforts have resulted in producing a vacuum that approximates a void more closely than that of any other experimenter, Ruggles estimates that a sixty-watt light bulb from which he has removed the maximum possible amount of air still contains about 500,000,000,000 gas molecules.



Experimenters at the Armour Institute adjusting their high-pressure machine



Any quantity of checks may be signed with this automatic unit

## Automatic Machine Copies Signatures

**SIGNATURES** are written automatically by a new electric signing machine invented by Glenn W. Watson, of Detroit, Mich. The unit employs a conventional fountain pen, which is guided by an "electric hand" to reproduce as many copies of a signature as desired. "Hand-written" letters can also be produced with the automatic writer.

## Plane Pilot Sights Highest Waterfall in World

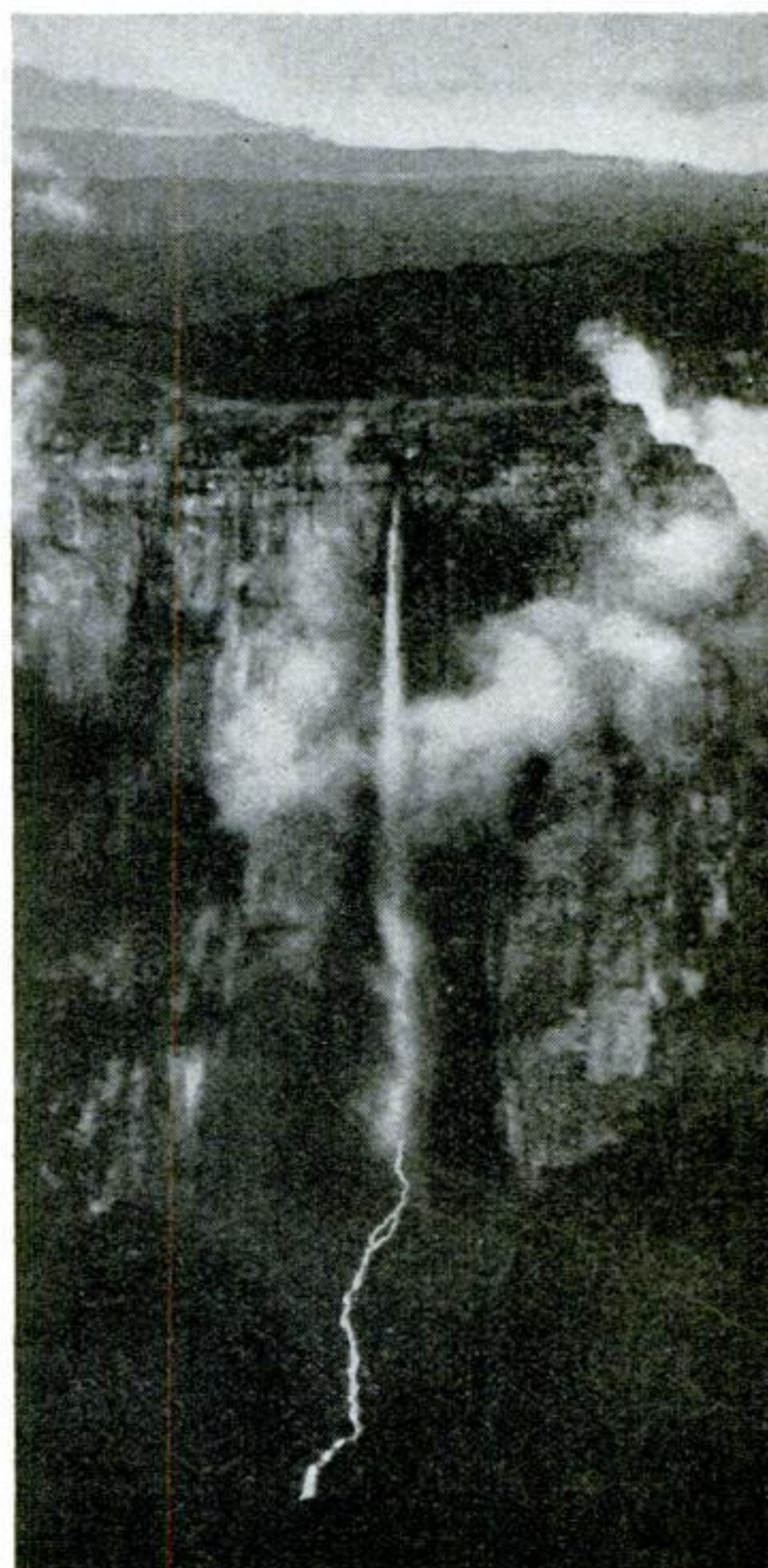
**FALLING** for a sheer drop estimated at over 5,000 feet, a South American cataract, discovered recently by an American aviator flying over a Venezuelan jungle, is said to be higher than any other waterfall known. Judged from altimeter readings in the plane, the water drops about 5,000 feet, swirls along a plateau, and falls another 1,000 feet before forming a stream emptying into the Caroni River, a tributary of the Orinoco in southeastern Venezuela.

## Gaiters Save Stockings



Made of oiled silk, the gaiters protect stockings from rain

**TRANSPARENT** knee-length gaiters invented by Lloyd Peterson, of Los Angeles, Calif., and displayed at a recent fashion show, are designed to protect women's silk stockings during rainy weather. Made of oiled silk, the gaiters are provided with elastic bands to hold them in place at the top and bottom, to protect the gap between raincoat and overshoes, as pictured at the left.



Air view of the Venezuelan waterfall that is said to have a sheer drop of almost a mile

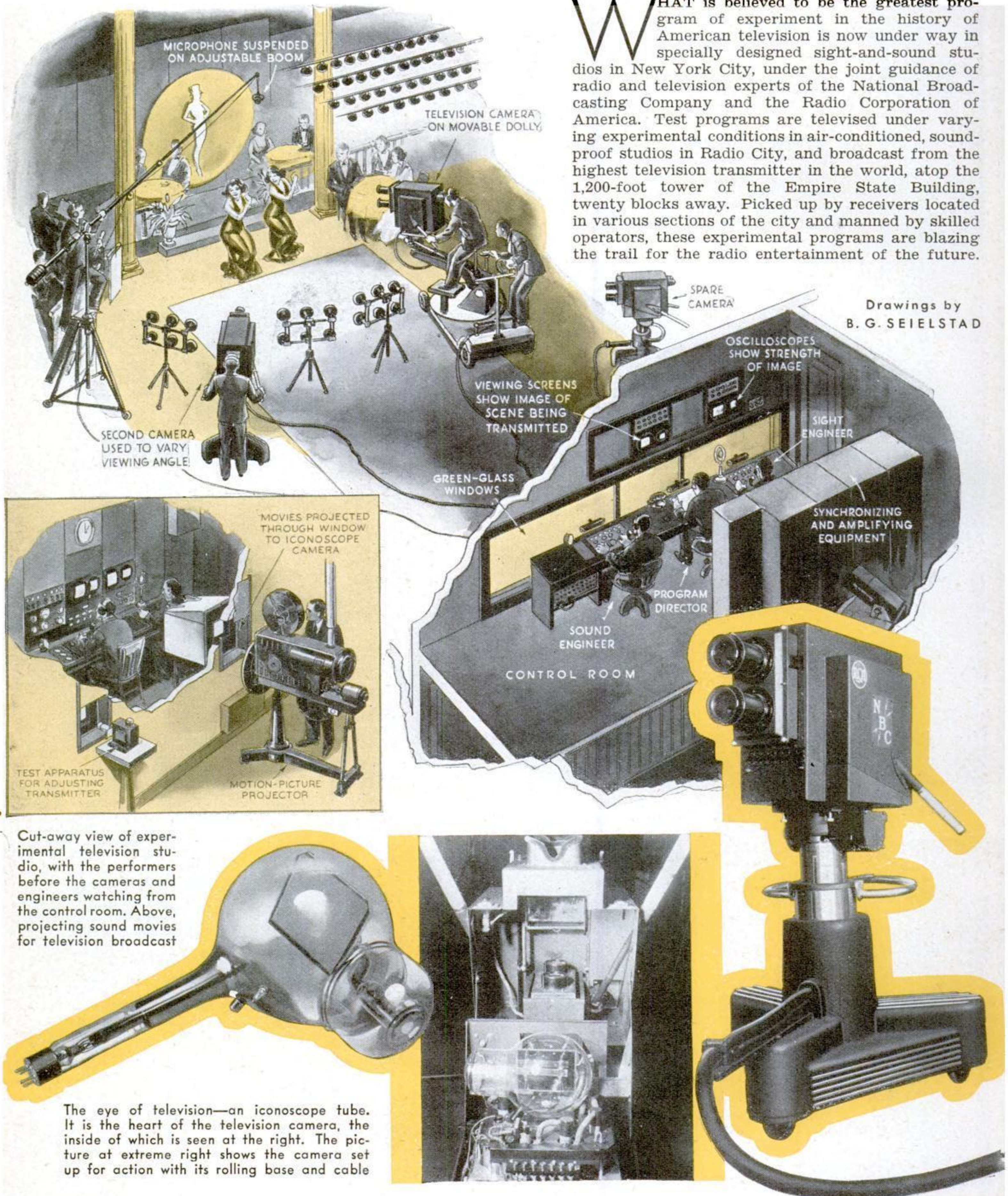


# TELEVISION

## ...MODERN TRANSMITTING METHODS

WHAT is believed to be the greatest program of experiment in the history of American television is now under way in specially designed sight-and-sound studios in New York City, under the joint guidance of radio and television experts of the National Broadcasting Company and the Radio Corporation of America. Test programs are televised under varying experimental conditions in air-conditioned, sound-proof studios in Radio City, and broadcast from the highest television transmitter in the world, atop the 1,200-foot tower of the Empire State Building, twenty blocks away. Picked up by receivers located in various sections of the city and manned by skilled operators, these experimental programs are blazing the trail for the radio entertainment of the future.

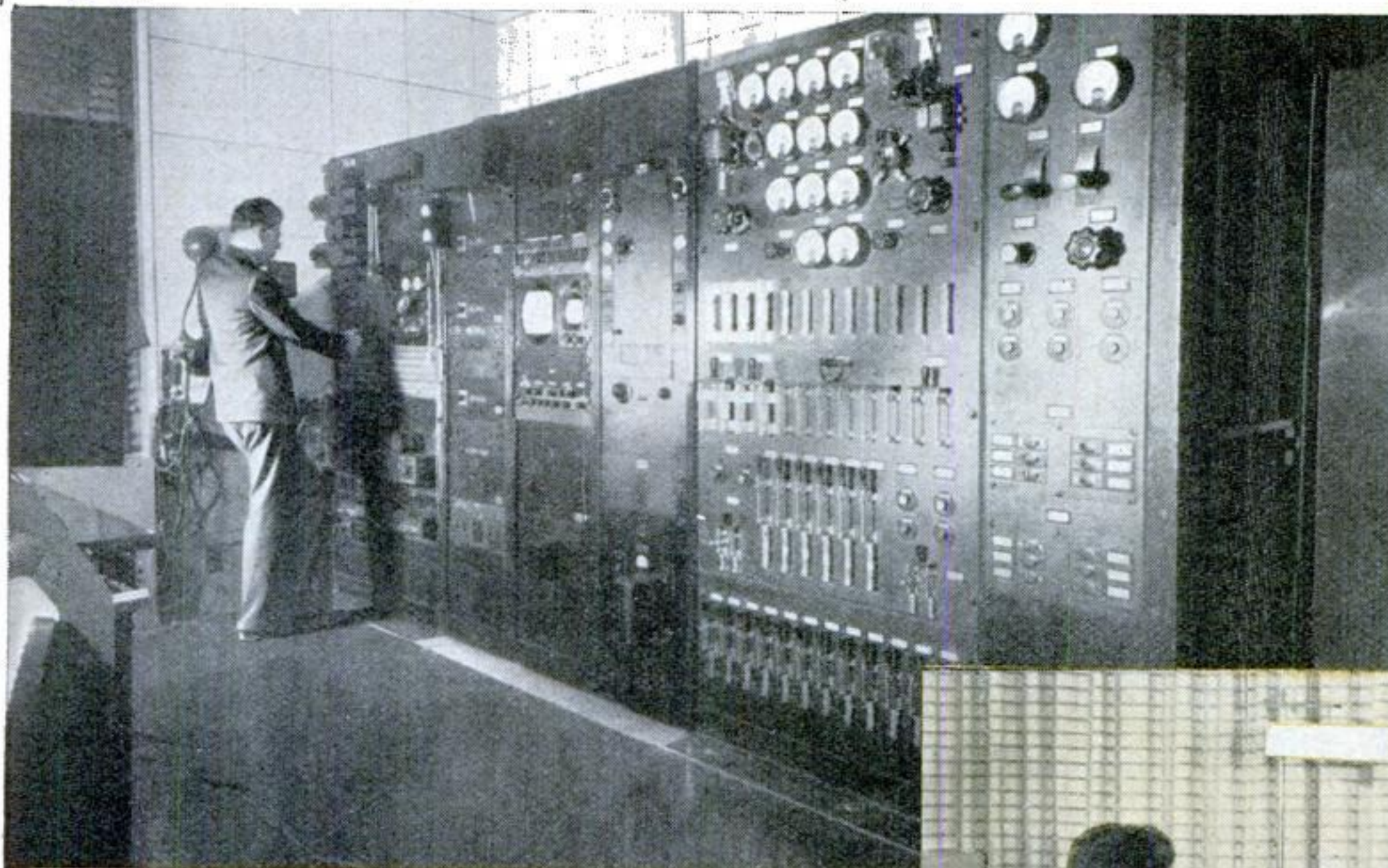
Drawings by  
B. G. SEIELSTAD



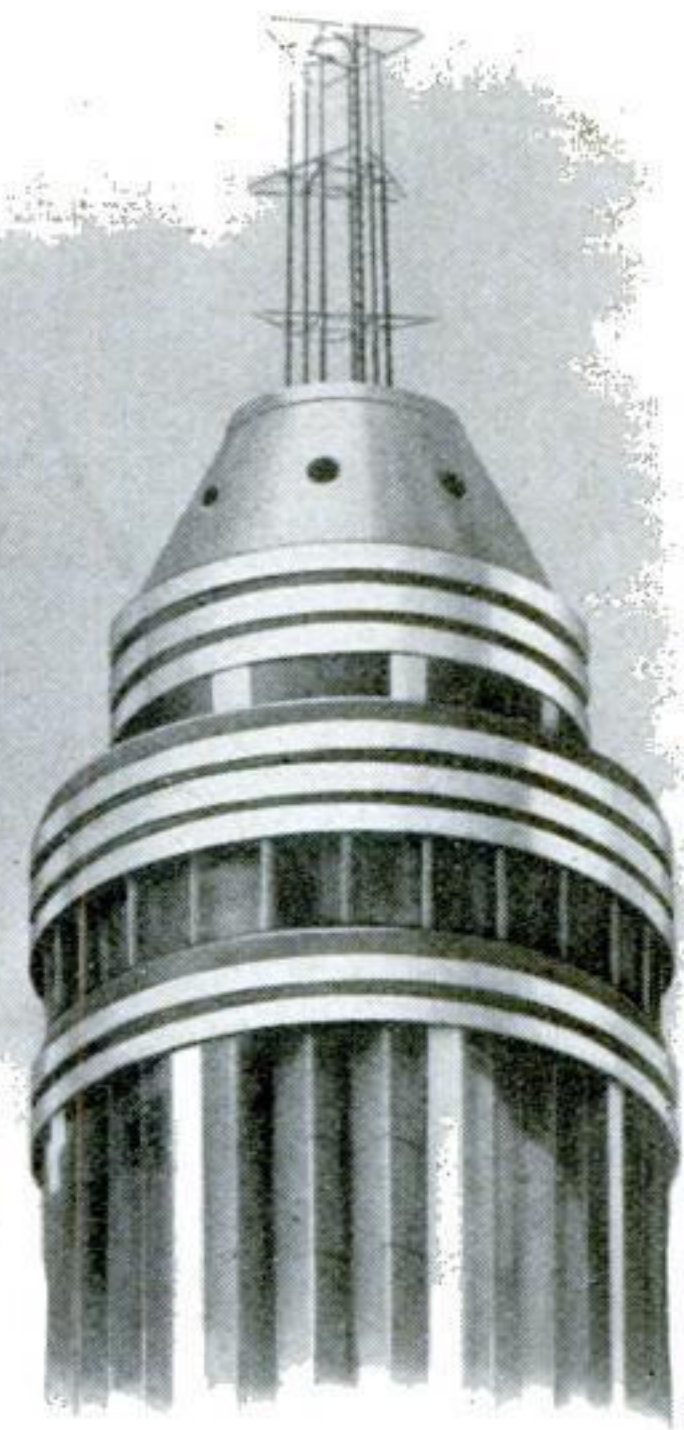


# Gets a Trial

## TESTED IN NEW STUDIO



Control panel in the RCA television transmitting station in the Empire State Building, New York City, to which programs are wired from the studios in near-by Radio City. At the far right is the antenna atop the world's tallest skyscraper



In the main studio, performers wearing special television make-up are bathed in brilliant light from great batteries of spotlights and floodlights. Their images are "scanned" by the television camera, and changed into a complicated series of electric impulses. Sometimes, several cameras are used to vary the view and make both close-ups and long shots possible.

Through a large glass window, covered with a green cellulose material to dim the glare of the studio lights, engineers in the control room can watch the performance while they manipulate a maze of operating controls. From the control room, the picture and sound signals, in electric-impulse form, are transferred through a special transmission cable to the transmitter in the Empire State Building and sent out on the air.

In another Radio City studio, standard 16 or 35-mm. motion-picture film is projected from a fireproof room through glass ports into a television camera in an adjoining control room. By means of this system, regular motion-picture features can be put on the air.

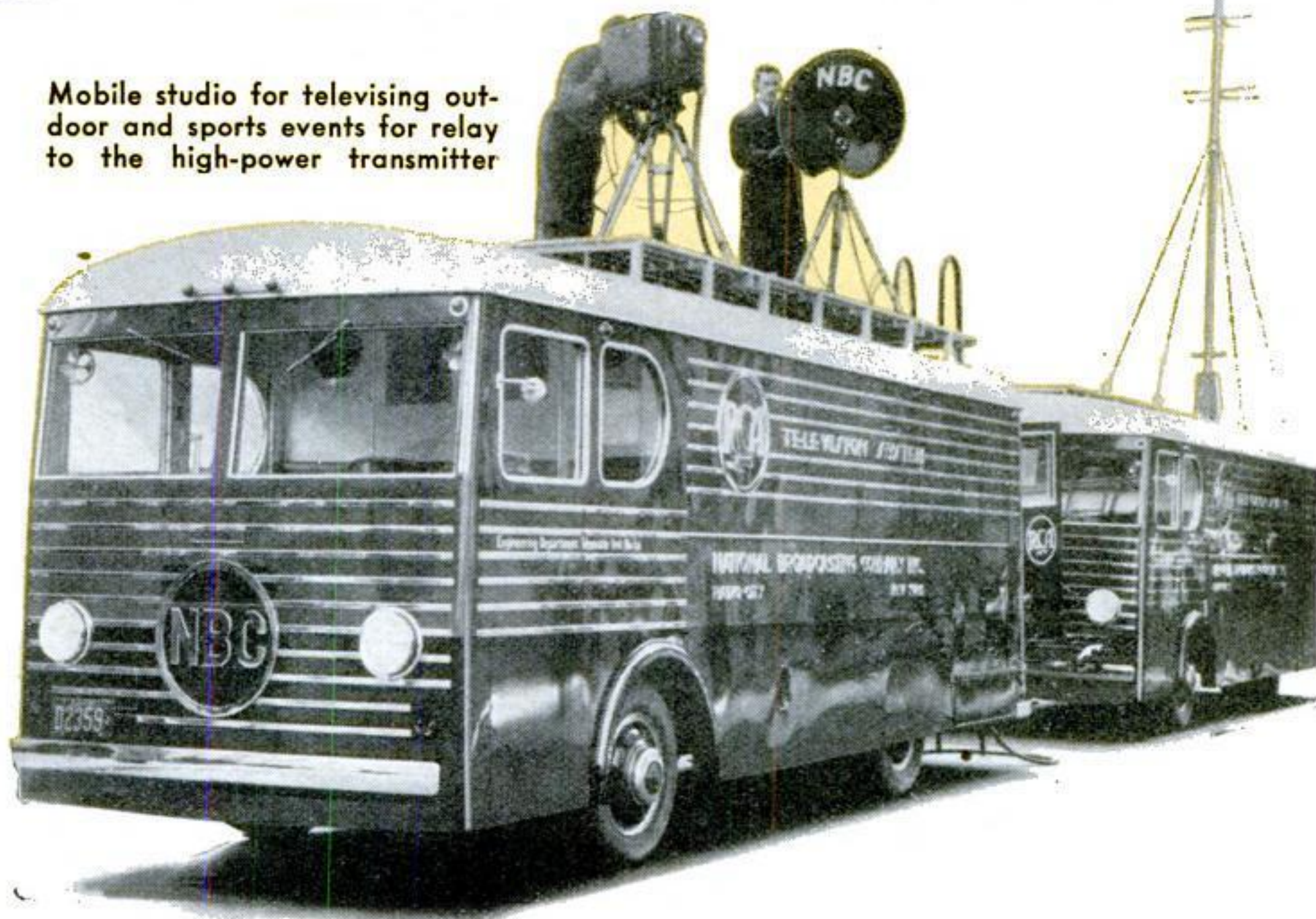
Through this experimental work, engineers hope to apply the finishing touches to the mechanics of television, take sight transmission out of the experimental stage, and establish it in its destined place beside radio in the American home.



How television programs are received in homes. Left, an image of a test manikin on the screen



Mobile studio for televising outdoor and sports events for relay to the high-power transmitter



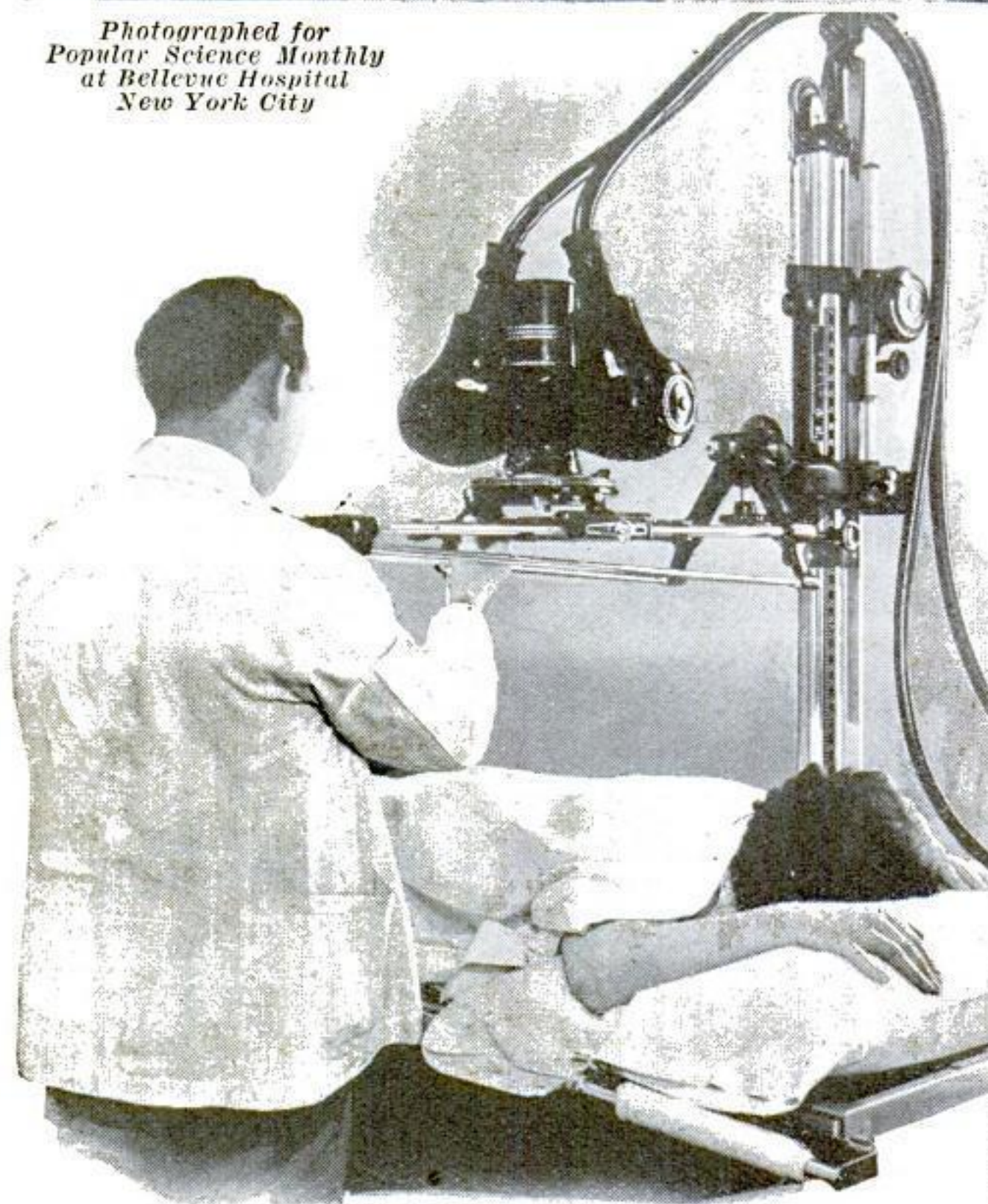


# HOW MEDICAL EXPERTS ADMINISTER Modern Anesthetics



Photographed for  
Popular Science Monthly  
at Bellevue Hospital  
New York City

**Highly Trained Specialists, Using Improved Methods  
and Materials, Stand Guard Over Your Safety When  
You Take Your Place Upon the Operating Table Today**



**1** Upon admission to the hospital, the patient is given a thorough examination, and X-ray pictures are made, to provide accurate knowledge of the conditions

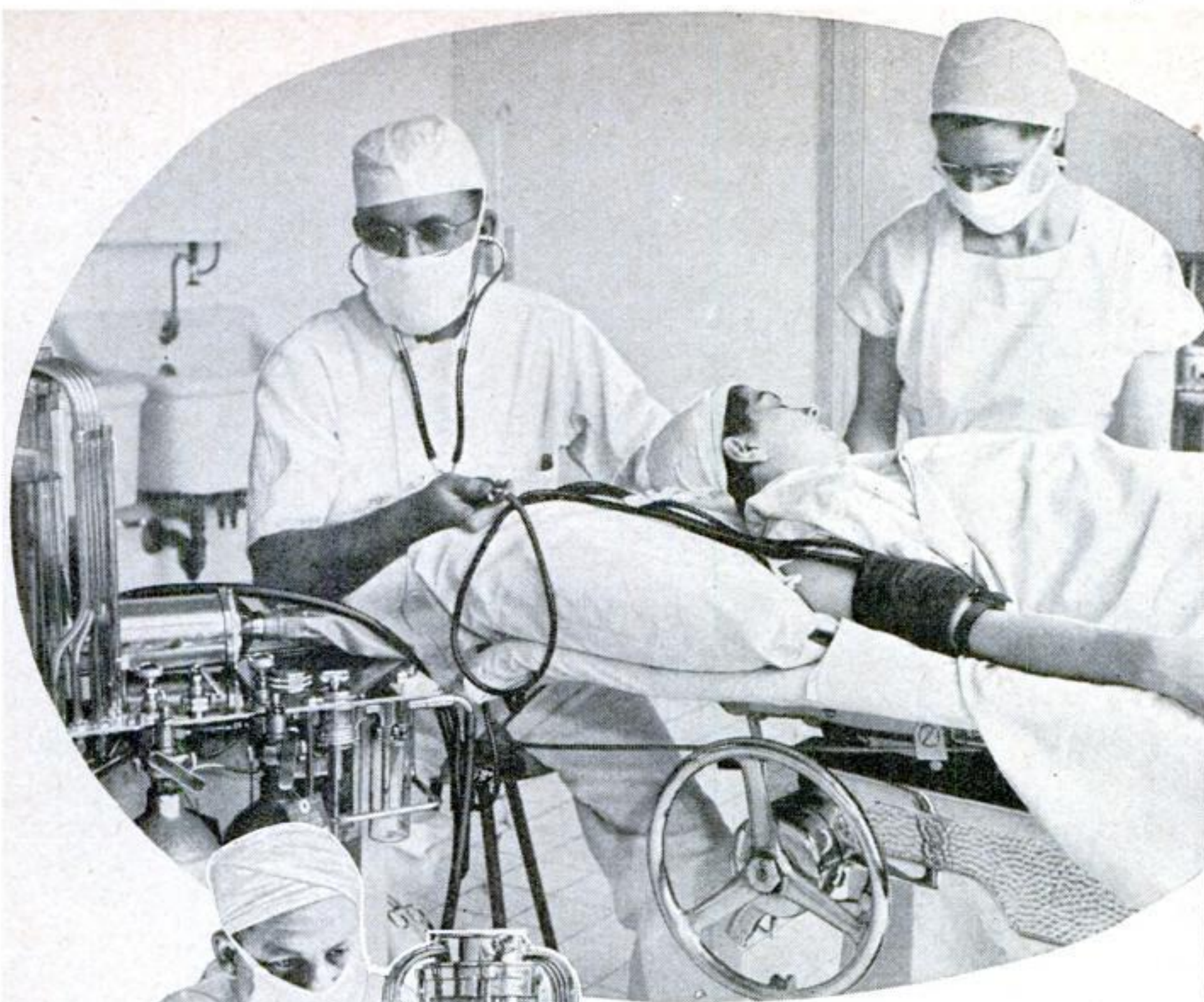
**2** A short time before the operation is to be performed, a nurse administers a sedative. This removes nervous tension and puts the patient into the calm, restful state that is favorable to success



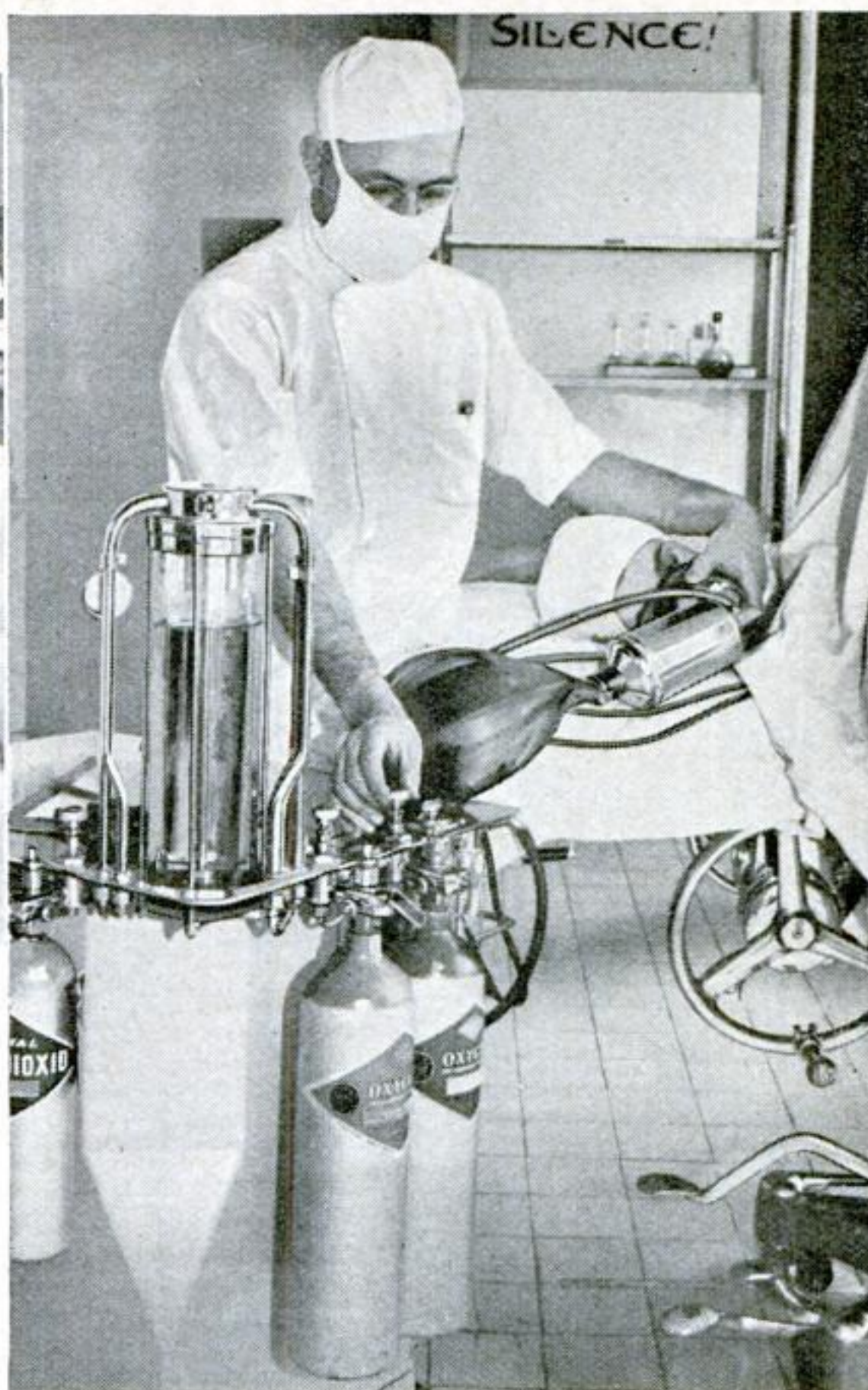
**F**ROM the hit-or-miss methods of a few generations ago, the use of anesthetics has developed into a precise science that eliminates nausea, eases the strain on the patient, and reduces the number of fatalities in the operating room. On these pages, the camera takes you behind the scenes in a great modern hospital—Bellevue, in New York City—and reveals the steps by means of which the present-day anesthetist safeguards the life of his patient.

Fifteen thousand operations a year are performed in this one hospital alone. Long before the patients are wheeled into the presence of the surgeons, they have undergone a thorough X-ray examination and have had their blood pressure, pulse, and breathing tested. At intervals of a few minutes, all through an operation, the anesthetist records variations

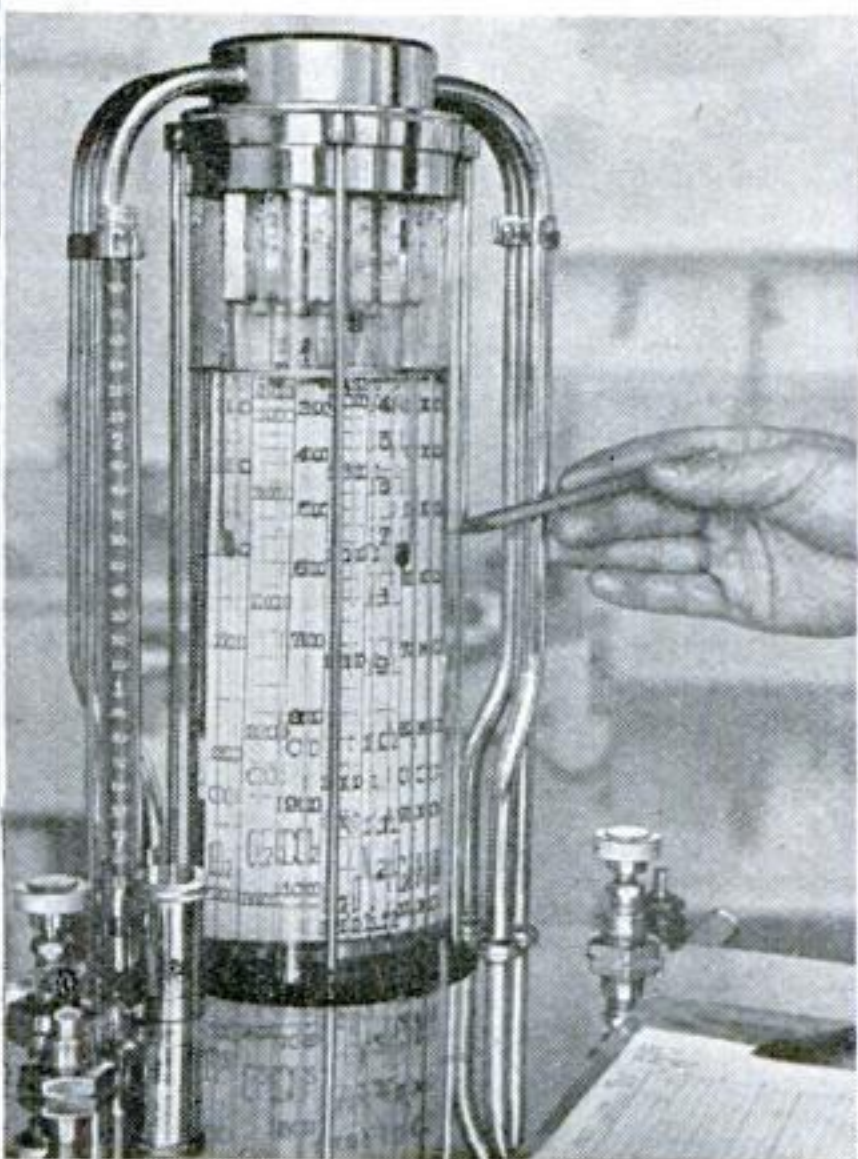




**3** In the operating room, blood pressure and pulse are taken by means of a mercury manometer that is part of the anesthetic apparatus



**4** A trained anesthetist manipulates the valves that feed gases to the patient. The graduated tubes seen in the picture at the right show the volume of gas used, and the operator varies the mixture to suit changes in the patient's condition



in pulse, breathing, and blood pressure. If these indicate shock or too great loss of blood, glucose and saline solution are forced into the veins of the patient, or a transfusion is performed while the operation goes on.

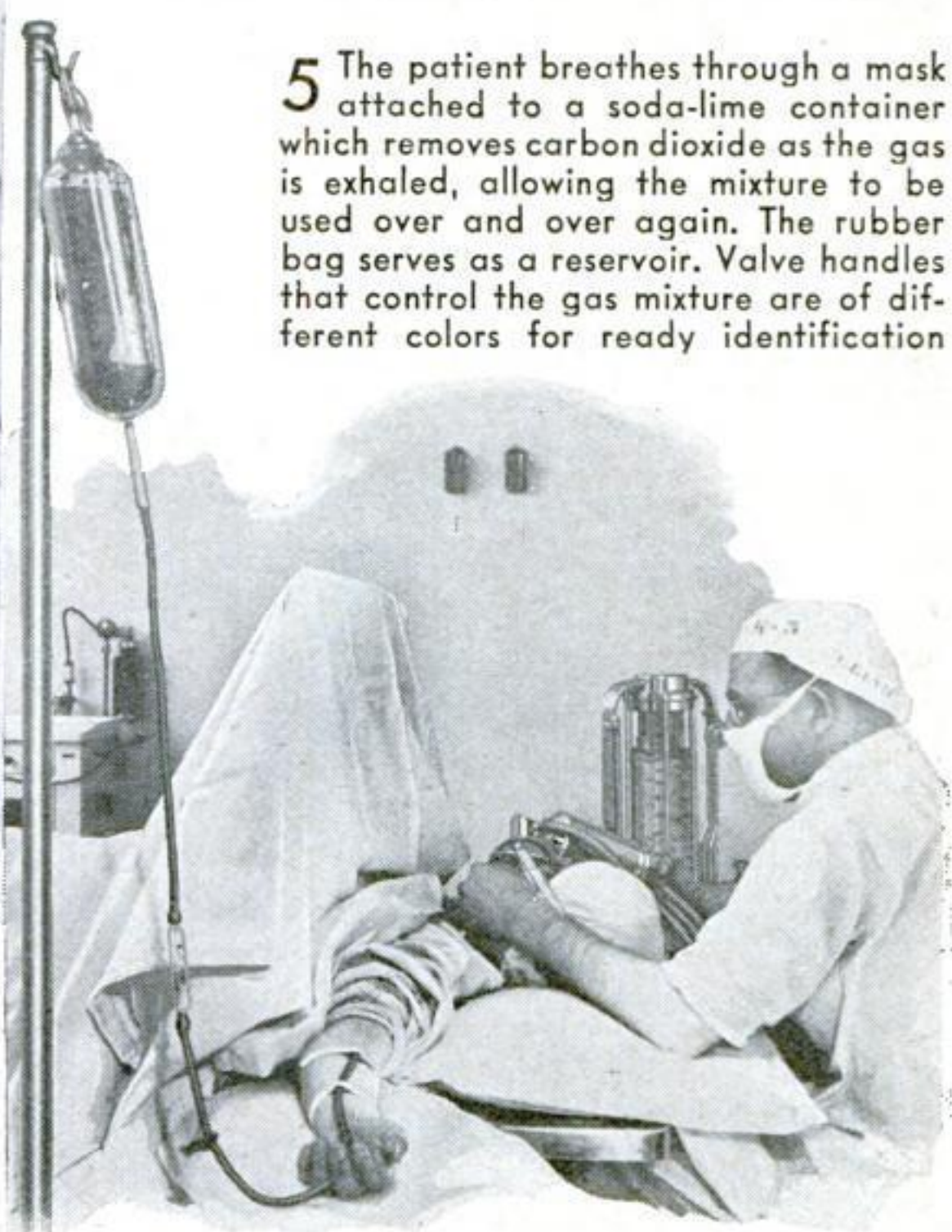
Recently, an apparatus for administering anesthetics, perfected by Dr. Ralph M. Waters, has been adopted by leading hospitals. At one end is a mask which fits over the face of the patient, at the other is a rubber bag. Between is a container of soda lime which removes the carbon dioxide which the patient breathes out. Once the rubber bag is filled with ether or other gaseous anesthetic, the main supply can be shut off. The patient breathes the same vapors over and over again.

By operating a series of valves on what looks like a large control board, the anesthetist can vary the amount of

oxygen and anesthetic the patient receives at any time during the operation. Graduated scales on a flow meter indicate at all times the amount of gas passing through. The various anesthetics, compressed into cylinders, are arranged around the meter for use as desired. Ether is still the most widely used, although some of the newer anesthetics, such as cyclopropane and vinylene, are growing in popularity.

In cases of obstructed breathing passages, the anesthetic is administered direct to the lungs through a rubber tube. This is put in place by use of a laryngoscope, a hollow, tubelike blade with a light at the end. Once the tube has been slipped through it, the device is removed and the anesthetic, mixed with

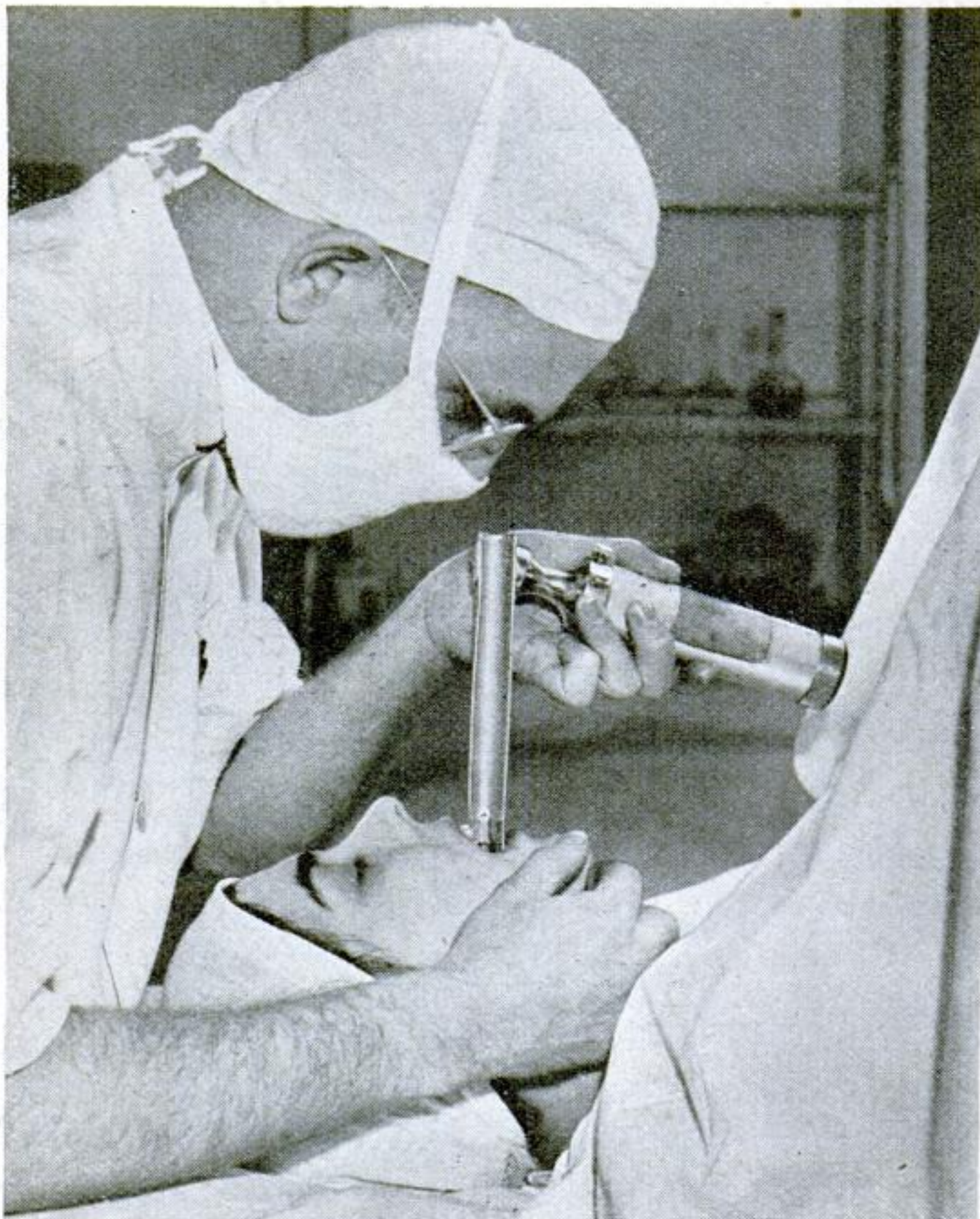
**5** The patient breathes through a mask attached to a soda-lime container which removes carbon dioxide as the gas is exhaled, allowing the mixture to be used over and over again. The rubber bag serves as a reservoir. Valve handles that control the gas mixture are of different colors for ready identification



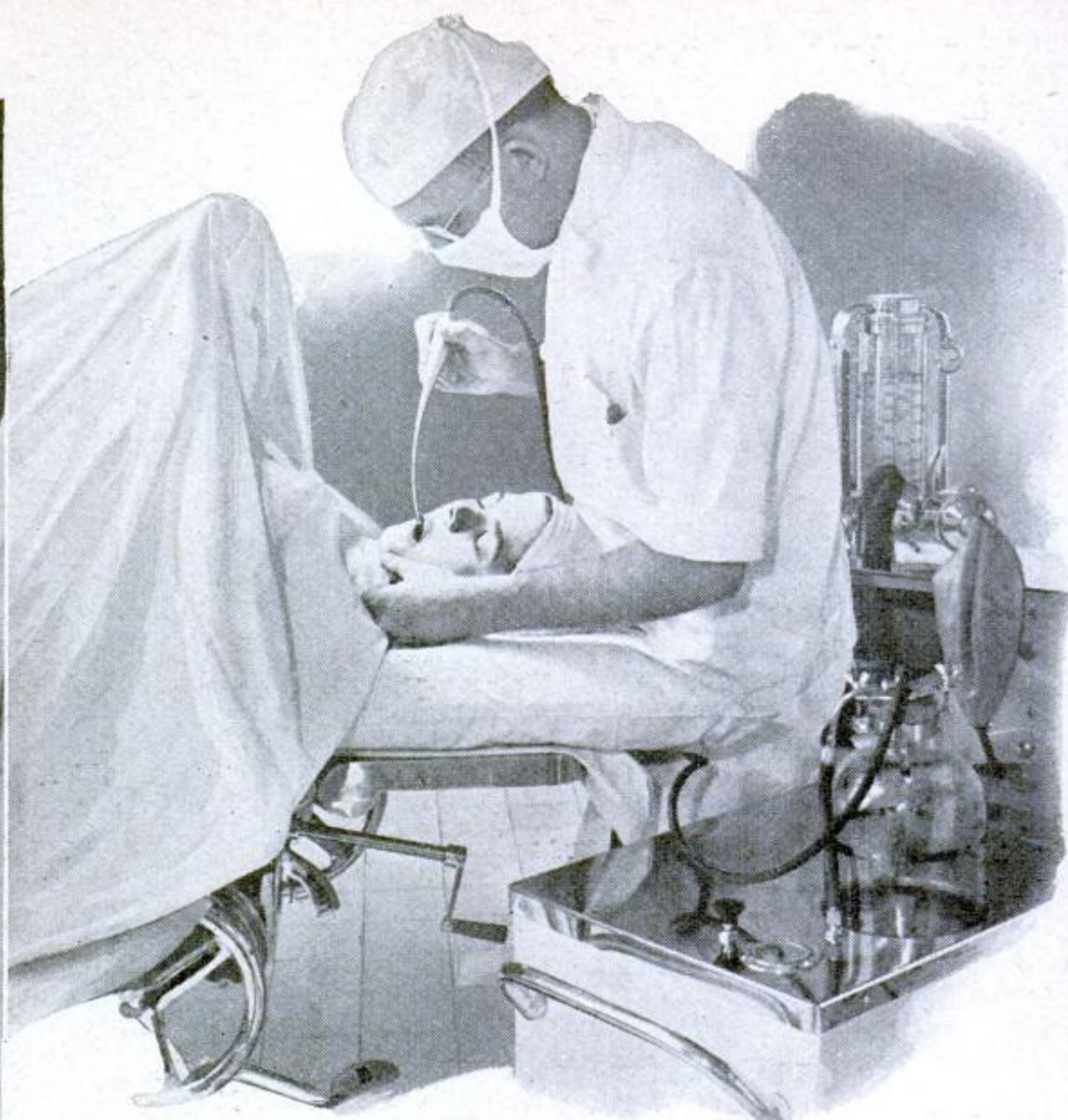
**6** If the patient suffers from shock or loss of blood, an infusion of saline solution and glucose is made to flow from an elevated container into an arm vein. Throughout the operation, pulse, blood pressure, and other details are recorded. (Continued on next page)

oxygen, is administered. This innovation also permits a dramatic phase of the work of the modern anesthetist—keeping the lungs in action when the patient stops breathing! By pressing rhythmically on a rubber bag attached to the outer end of the tube, he continues to force air into the lungs until the body resumes its normal functioning.



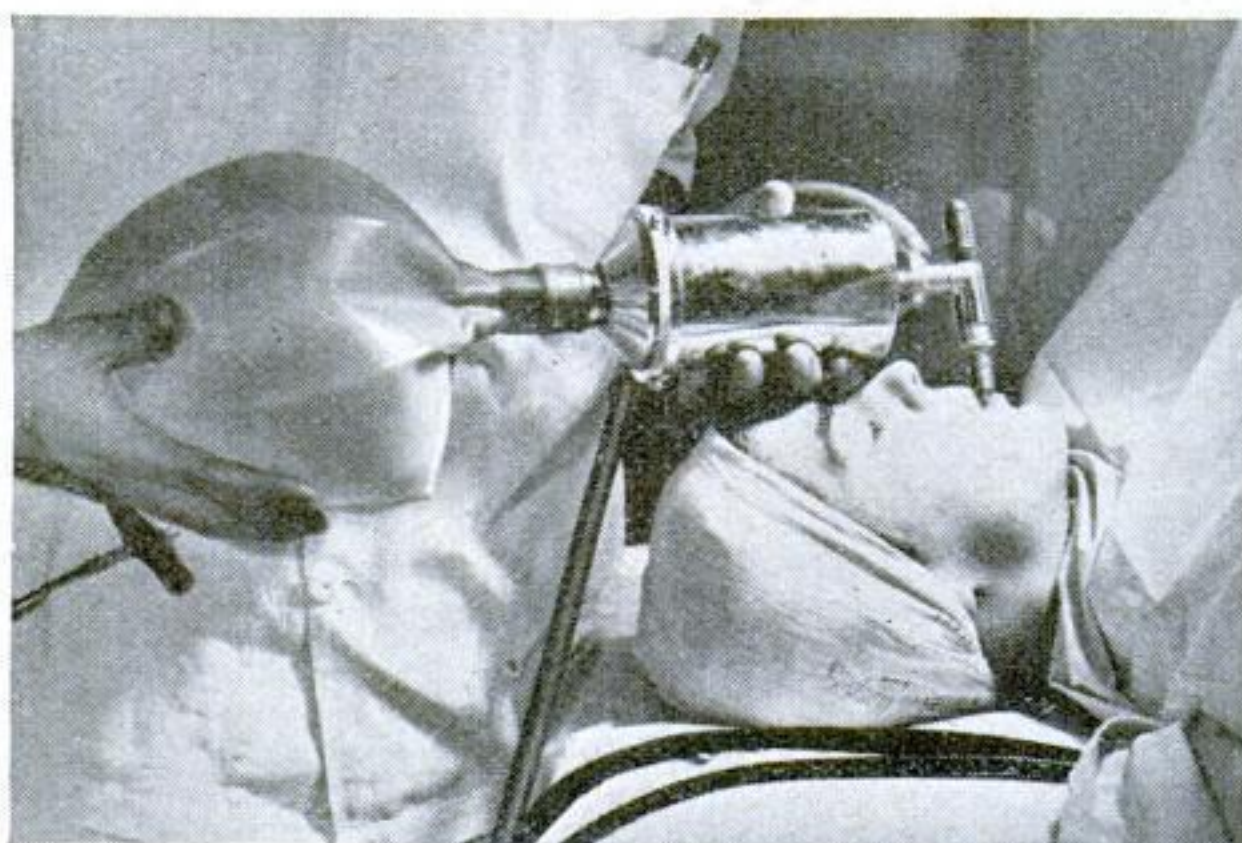


**8** When it is necessary to supply oxygen or gas directly to the lungs, a laryngoscope is employed to guide the endotracheal tube past the vocal cords. Seen in use in the picture above, the laryngoscope has a flashlight battery in its handle and an incandescent bulb in its tip to light up the throat passage for the anesthetist, who looks down a hollow blade

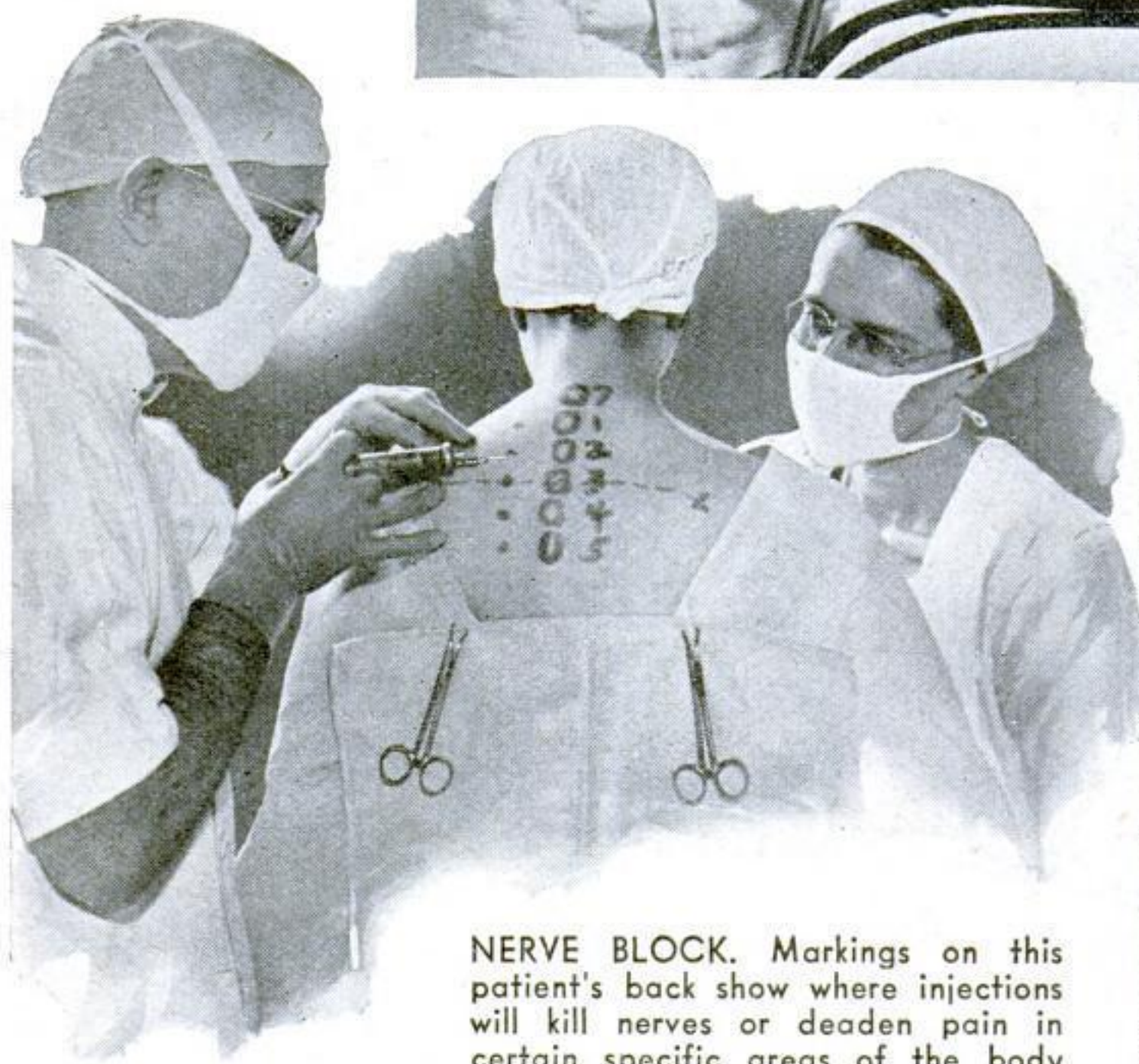


**7** To prevent nausea, any mucus or blood that may have collected in the mouth is removed by means of this aspirator tube, which operates by suction like the device dentists use for a similar purpose

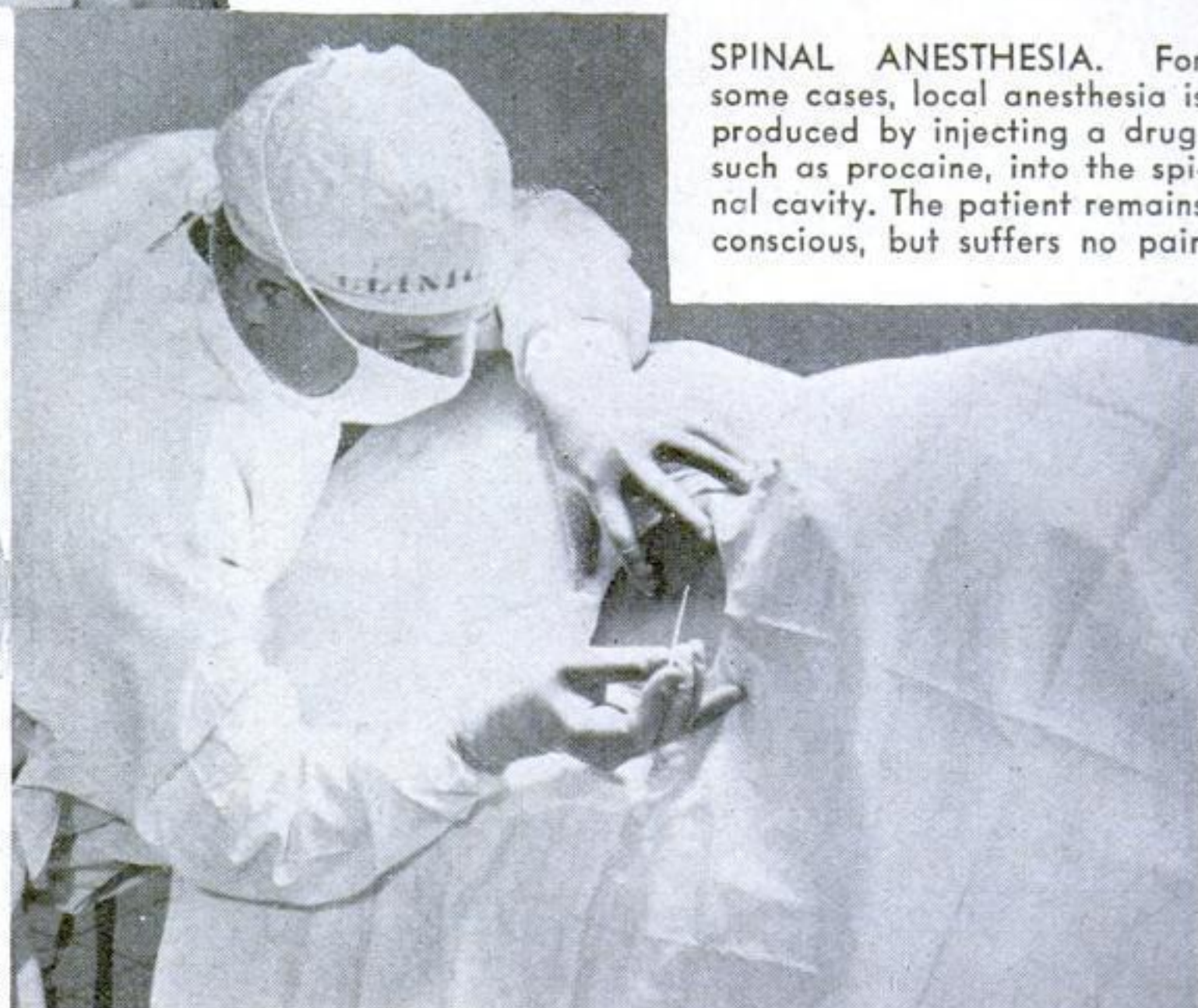
**9** Here the endotracheal tube is inserted in the throat to supply the gas to the lungs. A rubber cuff around the tube blocks the throat. In emergencies, this apparatus can be used to promote breathing simply by squeezing the large rubber bag



**10** After the operation, the patient may need oxygen as an aid to recovery. The arrangement pictured above insures a steady, dependable supply in the amount required

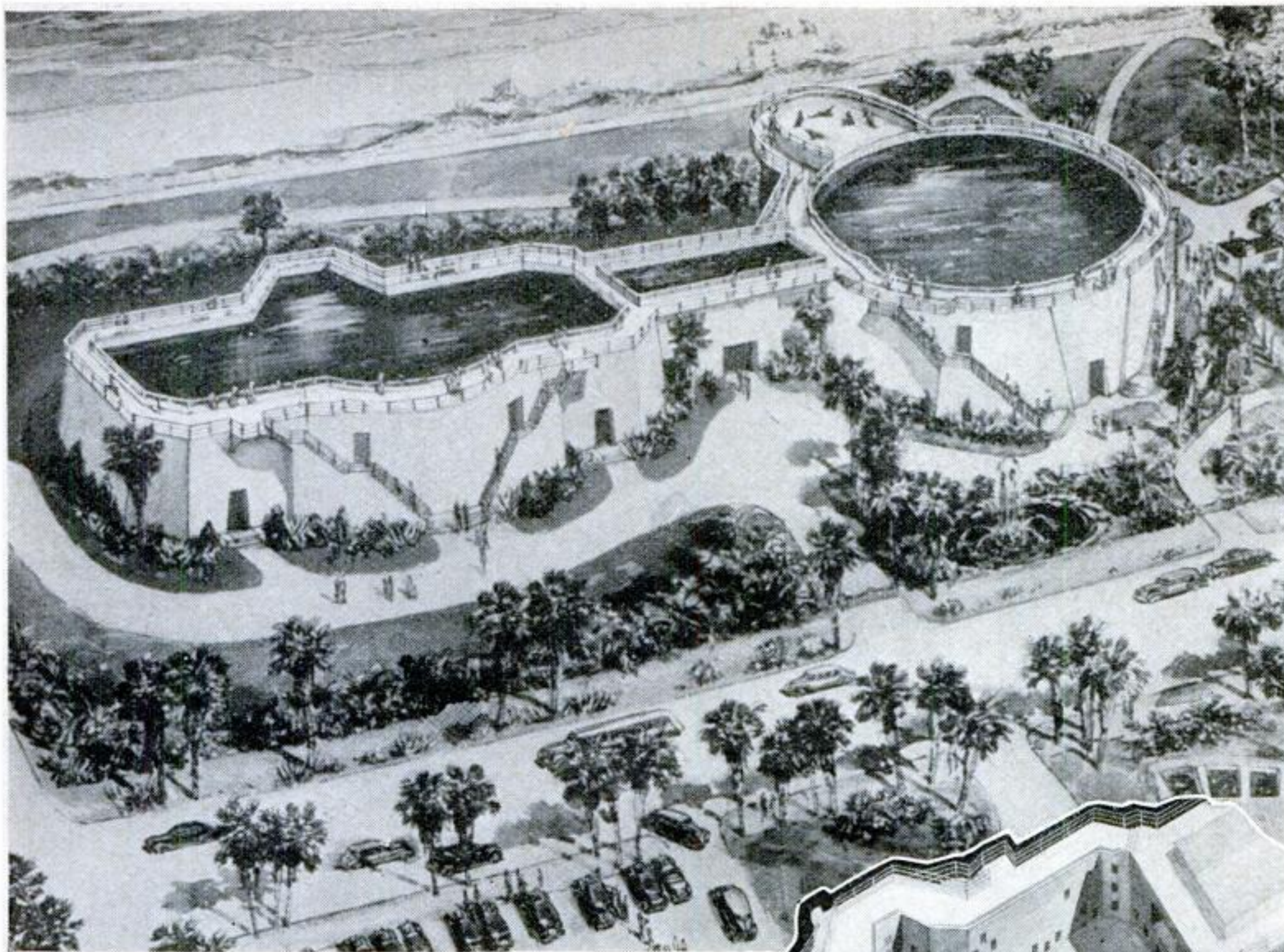


**NERVE BLOCK.** Markings on this patient's back show where injections will kill nerves or deaden pain in certain specific areas of the body



**SPINAL ANESTHESIA.** For some cases, local anesthesia is produced by injecting a drug, such as procaine, into the spinal cavity. The patient remains conscious, but suffers no pain





Visitors ascend outside stairs to enter various viewing galleries of the huge aquariums

## Giant Aquarium Is Miniature Ocean

**D**UPLICATING conditions found in the open sea, two giant sea-water tanks are combined into one aquarium near St. Augustine, Fla., to serve as oceans in miniature for the observation of underwater life. Of the building's two illuminated observation tanks, one is rectangular, 100 feet long and eighteen feet deep, and the other circular, seventy-five feet in diameter and eleven feet deep. Enclosed galleries run at different levels around and beneath the

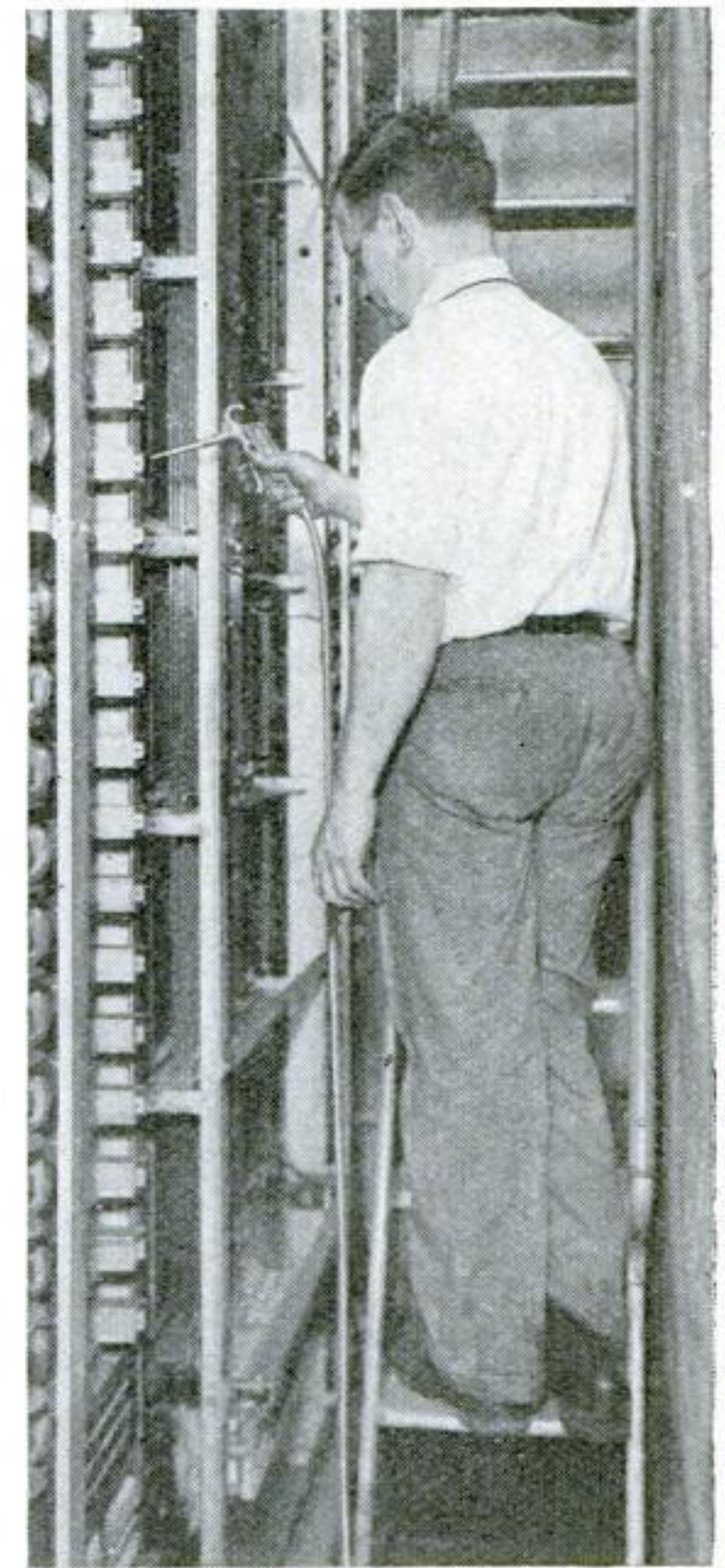


Above, water-tight windows of tank walls separate the spectators from the water

tanks, from which visitors can observe the marine life through the 200 portholes built into the sides and bottom. A boat of special design will be used to secure live specimens for the unique aquarium.

## New Blower Dusts Off Telephone Equipment

TO REMOVE dust and dirt from banks of switches, relays, and other delicate mechanisms that operate a dial-telephone system, a new cleaning process utilizes compressed air. From a portable, electrically operated compressor, air is blown through the nozzle of an air gun, shown in use below. Dislodged dust is drawn off by a suction fan.



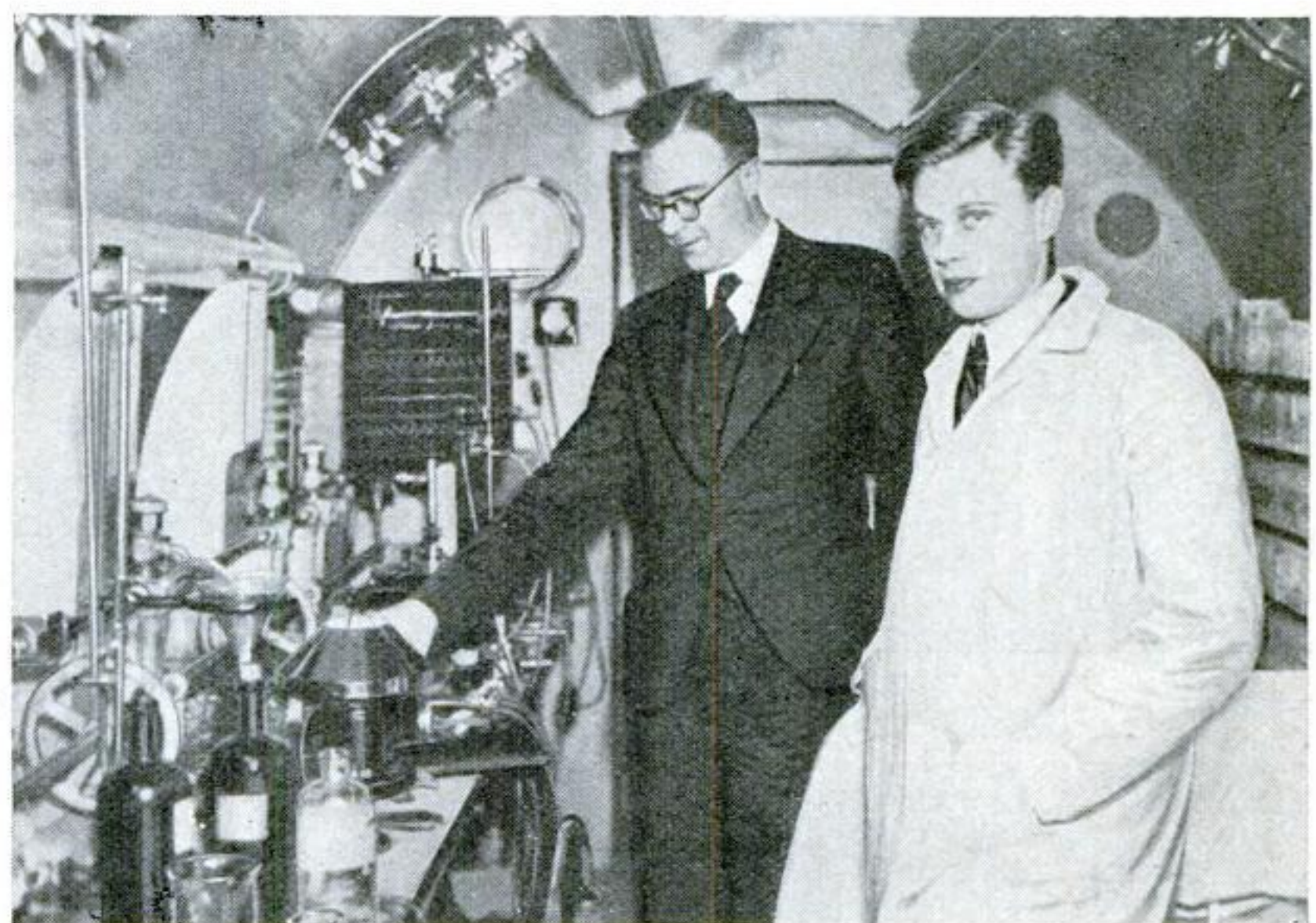
As the pistol-shaped blower forces dust out, a vacuum unit collects it in a bag

## Scale Dial Is Easy To Read

**DIAL** visibility from any angle is a feature of a new postal weighing scale. A control knob shifts the illuminated dial to make it easy to read when the scale is above, below, or on a line with the observer. The dial shows charges for any of the eight postal zones.



Turning a handy knob brings the scale's dial into easy view

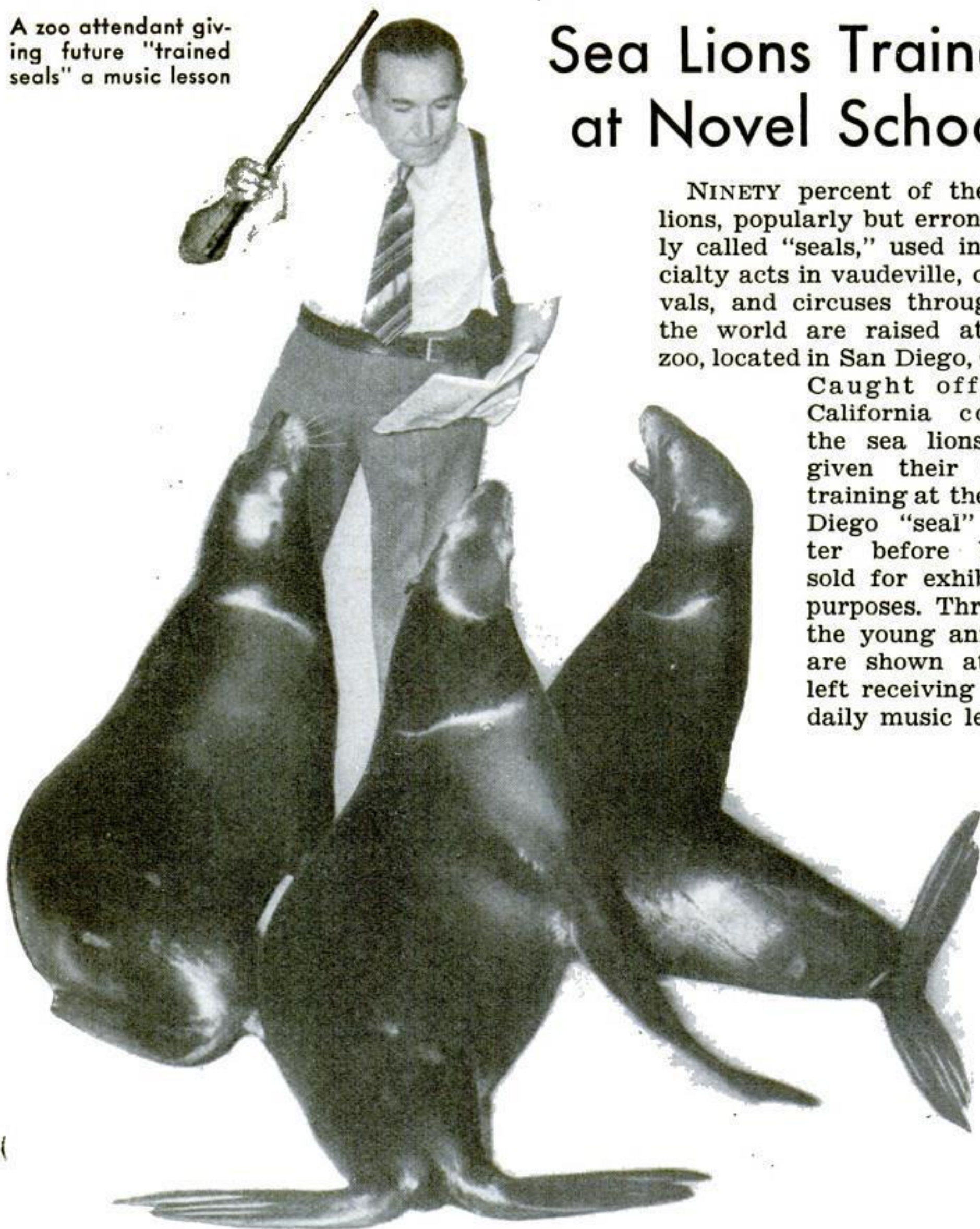


## Flyers Get Test In "Altitude" Tank

TO DETERMINE the effects on the human body of long exposure to high altitudes, two air-minded Belgian experimenters lived for six days in a sealed chamber where the reduced pressure equalled that found 12,000 feet above the earth. While confined within the steel tank, the research workers employed a battery of instruments to check their bodily reactions to lowered atmospheric pressure.



A zoo attendant giving future "trained seals" a music lesson



## Sea Lions Trained at Novel School

NINETY percent of the sea lions, popularly but erroneously called "seals," used in specialty acts in vaudeville, carnivals, and circuses throughout the world are raised at one zoo, located in San Diego, Calif.

Caught off the California coast, the sea lions are given their early training at the San Diego "seal" center before being sold for exhibition purposes. Three of the young animals are shown at the left receiving their daily music lesson.



## Test Insect Parasites in Transparent Cages

SLEEVES made of transparent wrapping material cover plant stems to form "laboratories" for a study of insect parasites being carried on at the Botanical Gardens in Sydney, Australia. The cellulose jackets isolate sections of plants under observation to keep out other insects while foreign parasites are being studied to see whether they are suitable for combating native insect pests.



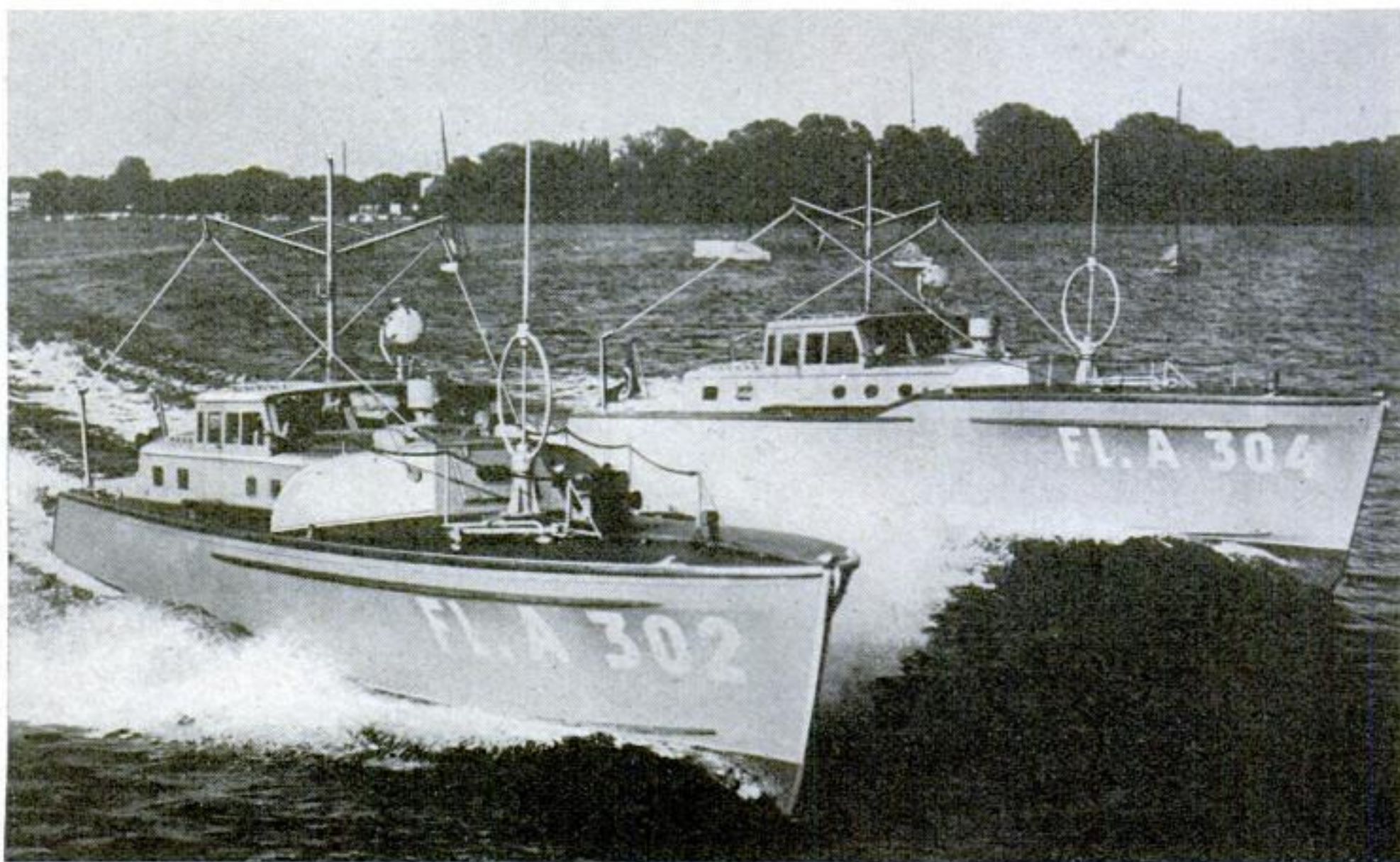
## Finger-Size Light Bulb Has 1,000-Watt Rating

LESS than four inches long and only a quarter of an inch in diameter, an experimental light bulb developed by Dr. O. P. Cleaver, a Westinghouse engineer, is rated at 1,000 watts. An electric arc within the midget lamp discharges through an atmosphere of mercury vapor to produce the illumination. The tiny bulb, submerged in water to keep it cool, is contrasted above with a conventional 1,000-watt lamp.

## Fast Motor Boats Aid Antiaircraft Defense

DESIGNED as auxiliary craft for air defense, high-speed motor boats just completed for German military authorities will be used in the North and Baltic seas to warn of the approach of an enemy air fleet in case of a wartime attack. Equipped with powerful motors for speedy reconnoitering maneuvers,

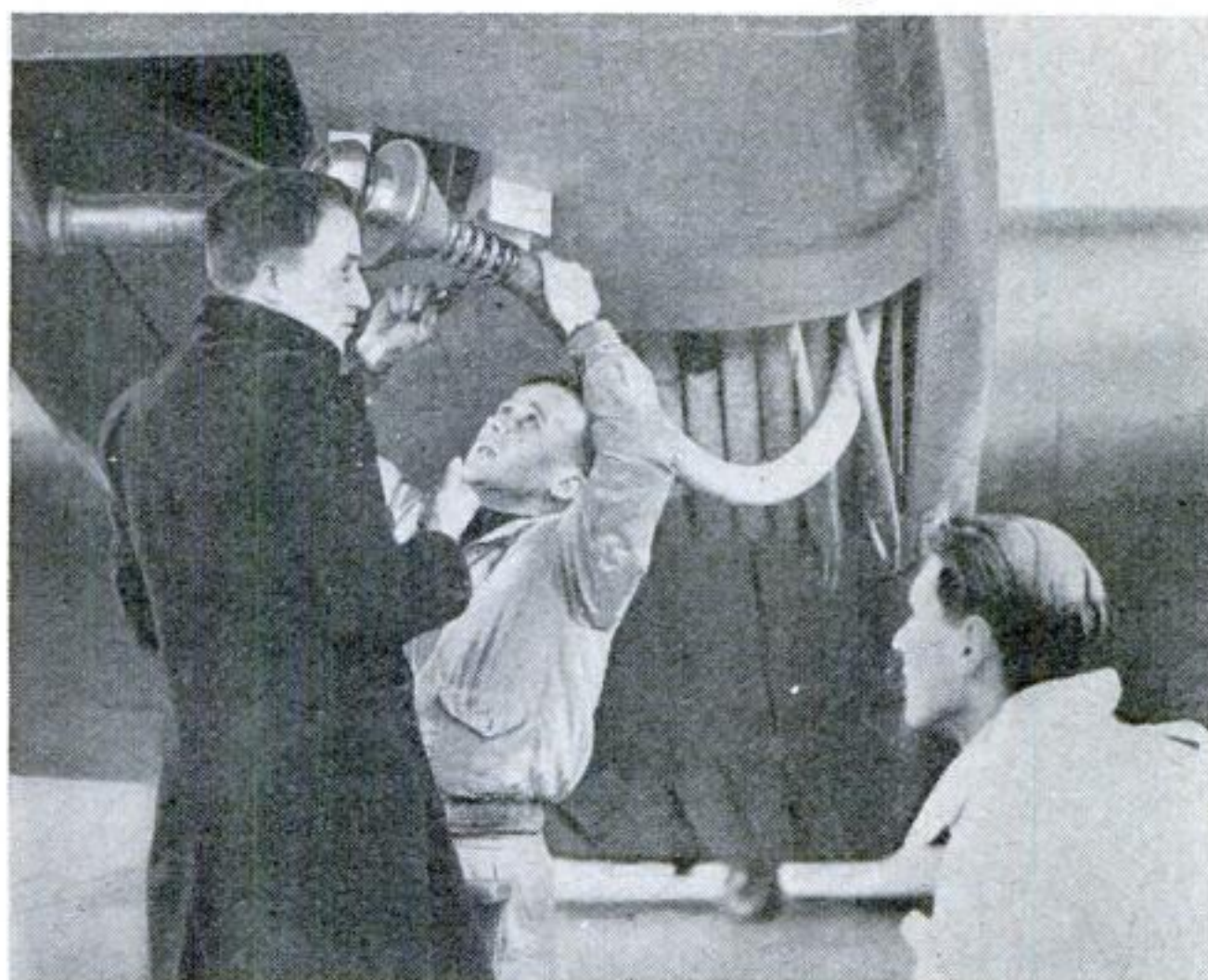
the craft carry complete short-wave radio equipment, direction finders, and radio homing devices. Cruising off the coast, the speedboats will also search for lost planes and aid disabled aircraft to reach airports or mother ships. The boats are shown below in a test run in German waters.



Two of the new auxiliary craft that will cooperate with German war planes against raids



## Reel Aids Refueling in Air



This hose is reeled out for refueling airplanes in flight

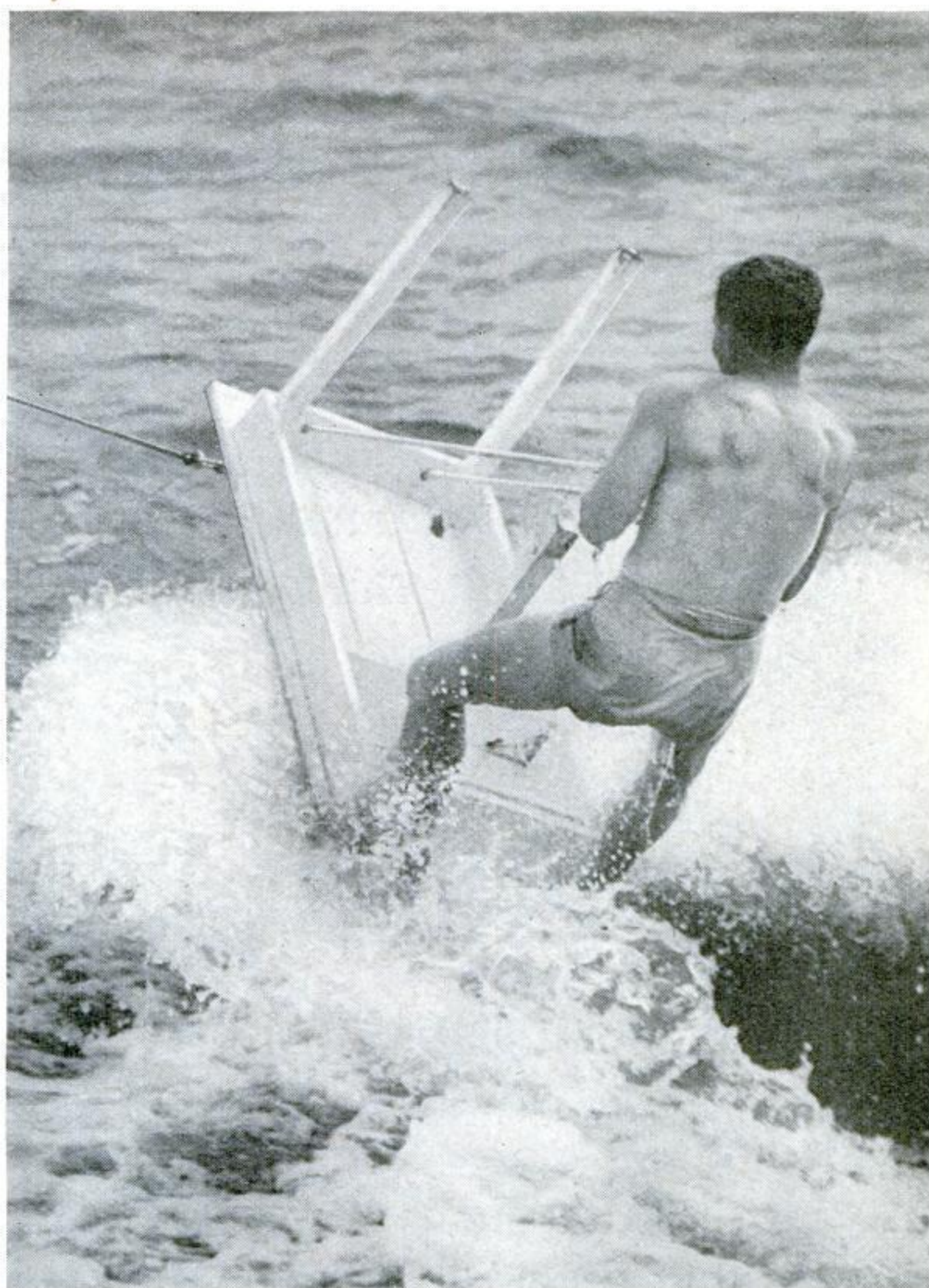
REFUELING planes in the air is made easier with the aid of a new device invented by Sir Alan Cobham, noted British aviator. A hose is rolled around a spool fitted into the bottom of the fueling plane so that it can be unwound or rolled up quickly during refueling operations. A cable holds the hose nozzle against the fuselage when the unit is not in use.

## Shaving Mirror Is Made for Electric Razor

DESIGNED especially for shavers using electric razors, an illuminated mirror provides an electric outlet for the razor and a covered receptacle in the base for storing it along with powder and other shaving accessories. A light is set into the bottom of the mirror glass.



Mirror with built-in light and outlet for an electric razor



## Table Skims Waves as an Aquaplane

STREAKING across the water behind a speeding motor boat, a Florida dare-devil used a common wooden table in place of the conventional aquaplane in a stunt ride performed at a popular Atlantic beach resort. Standing at one end of the overturned table, the rider clung to ropes fastened to one of the table rails. The photograph above was snapped from a second motor boat.

## Rolling Cage Protects Golf-Ball Retriever

ATTENDANTS who pick up the balls hit from a golf driving range are protected from stray tee shots by a novel cage on wheels. Triangular in shape, a wooden frame is mounted on three caster-type wheels and screened on all sides. Protected by this screening and by a canvas skirt that hangs down to the ground, the retriever pushes the cage around the range.



## Discarded Oil Tins Line Garage Walls

METAL cut from 3,000 discarded oil cans was used by Leo T. Dettloff of Oshkosh, Wis., to line the walls and ceiling of his three-car garage. The tin was applied with thousands of twopenny nails and finished with a double coat of white enamel.



Attendant at a golf driving range pushing his wire-screened cage around to pick up balls



# Jungles Underfoot

... CAMERA EXPLORER  
FINDS ADVENTURE  
IN HIS OWN BACK YARD



One of Edwin Teale's photographic masterpieces—a portrait of a praying mantis rearing its head out of the mysterious world of the grassroots

Here Teale is studying a bumblebee on a sunflower in his "insect garden" on Long Island

**D**URING the last decade, readers of this magazine have been familiar with Edwin Teale's adventure stories of science. In gathering first-hand information for these features, he has flown with a test pilot, walked under water in a diving suit, ridden all night with the radio patrol, gone on a training cruise in a submarine, and traveled 5,000 miles by trailer through the South.

But, behind this more spectacular work, there have been years of quiet, spare-time activity. Each summer, he acquires the "insect rights" to an ancient apple orchard near his home on Long Island, N. Y. Bounded on one side by a swamp and on another by an abandoned gravel pit, the group of gnarled trees, three quarters of a century old, shelters virtually every insect known to the region. Here, with notebook and camera, he has been pursuing his hobby, recording the strange and often baffling habits of these small creatures.

The resulting photographs have appeared in publications in England, France, Germany, Holland, Sweden, Switzerland, Canada, Australia, and India, as well as in the United States. A

few months ago, Dodd, Mead & Company, New York, published his first book on insects, "Grassroot Jungles." It contains more than 130 of the author's best photographs and is crammed with curious facts about the common insects he has studied. Such authorities as Dr. Leland O. Howard, formerly chief of the Bureau of Entomology, Washington, D. C., and Dr. Frank E. Lutz, Curator of Entomology at the American Museum of Natural History, New York City, have praised the scientific accuracy as well as the interesting style of the work. Schools in many sections of the country already have adopted it as supplementary reading for biology classes.

Half a dozen years ago, a curious experience started Teale recording insect stories on film as well as on paper. He saw a butterfly on a bush, and when he caught it in a net, he found he had two insects instead of one. The butterfly's body was half devoured and a praying mantis—a long, green relative of the walking-stick insect—clutched the remains in its spiked forelegs. When he tried to photograph the pair, the resulting picture was unsatisfactory. That started him studying the problems of

insect photography in earnest. As the harvest of this spare-time activity, he has assembled a file of approximately 5,000 negatives.

Among these thousands of pictures, the half dozen that gave him the most excitement form a set showing a death battle between a praying mantis and a black-widow spider.

One afternoon, in midsummer, he was focusing his camera on a mantis clinging to a low bush when he caught sight of a jet-black spider crawling up the side of a rock. The red hour-glass marking on its abdomen identified it as the venomous black widow. Drop for drop, its poison is said to be more deadly than that of a rattlesnake.

Interested in seeing what would happen when these two murderesses met—for both the black widow and the female mantis devour their husbands at the end of the mating season—he decided to transfer the spider to the bush. After inducing it to climb on a twig, about fourteen inches long, he started to carry it toward its destination. Instantly, the spider began running along the twig toward his hand. As it approached that end, the experimenter changed hands and took hold of the stick at the other end. The black widow whirled and sprinted back in that direction. Thus, shifting his hold back and forth as if he were carrying a hot potato, Teale succeeded in reaching the bush



## By ROBERT E. MARTIN

and depositing the spider near the mantis. At the end of five minutes, the mantis had imprisoned the spider in the toothed trap of its spiked forelegs and was calmly dining on its venomous foe.

The strange variety of insect fare and the amazing appetites possessed by some of these small creatures are reported in graphic terms by the insect explorer. A dragon fly, for example, will oftentimes consume its weight in flies during the space of two hours. If we ate as much in proportion to our size as the caterpillar of the monarch butterfly, we would sit down to 100 pounds of food at a single meal. In forty-eight days, the larva of the Polyphemus moth increases its weight 4,140 times. A ten-pound baby, growing at the same rate, would weigh twenty tons at the end of seven weeks!

Once, when Teale was examining a large green dragon fly, holding it by its transparent, parchmentlike wings, the insect suddenly curled up its abdomen and began devouring its own tail. On a number of other occasions, these creatures have been known to consume parts of their bodies to appease their hunger. Only the praying mantis and the robber fly have as wolfish appetites. In one instance, a dragon fly was mounted with a pin thrust through its body after being chloroformed. The anesthetic failed to kill it, and it revived. In spite of the terrible injury inflicted by the pin, it continued to gobble down flies as fast as they were offered. The pleasure of swallowing seemed to make it oblivious to its pain.

Exploring among the insects, Teale has found, is like making a Gulliver's journey into another world—a world in which the inhabitants wear their skeletons on the outside of their bodies, smell with their feelers, and, in some instances, have as many lenses in one eye

as are possessed by 15,000 humans. In following his hobby, he encountered Lilliputian carpenters and architects, spinners and tailors, warriors and weather prophets. He met the world's first musician, the cricket; the world's first weaver, the spider; the world's first paper maker, the wasp.

He learned of creatures that live for so short a time that they are born without mouths or stomachs; of others that change their skeletons from week to week; of others that live for years without a morsel of food; of others that use one set of eyes in the daytime and another at night.

Most of the bizarre living forms that he encountered can be observed by a home explorer in any back yard. Nine tenths of all the creatures on the face of the earth are insects. There are more different kinds than there are different kinds of plants, birds, and animals put together. Already, scientists have described and catalogued so many species that if you memorized twenty-five new names a day, it would take you sixty years to learn them all.

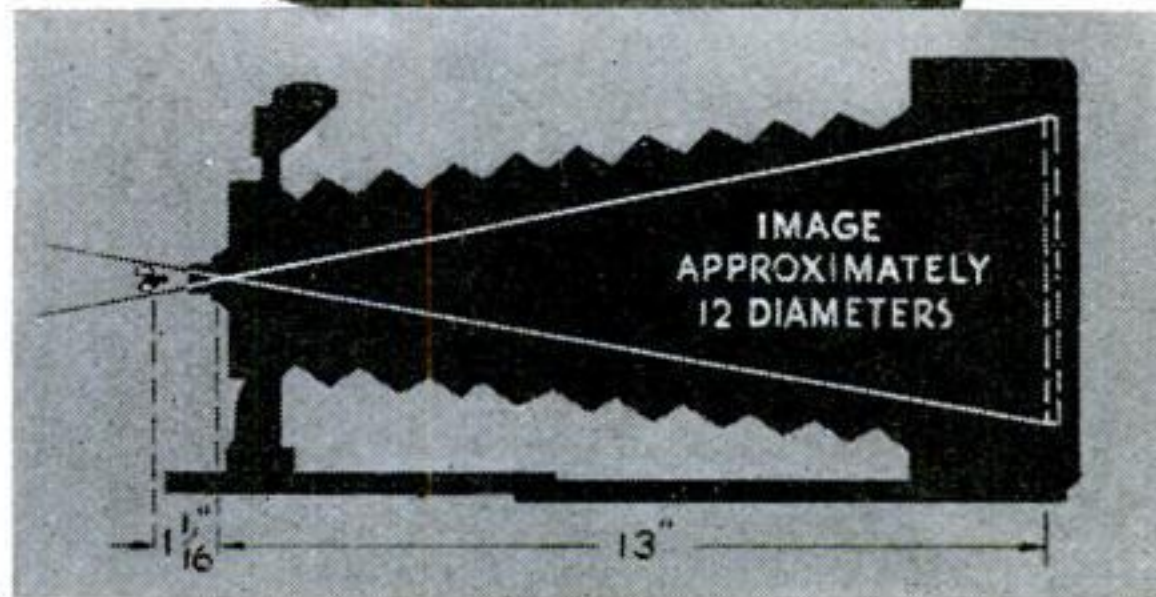
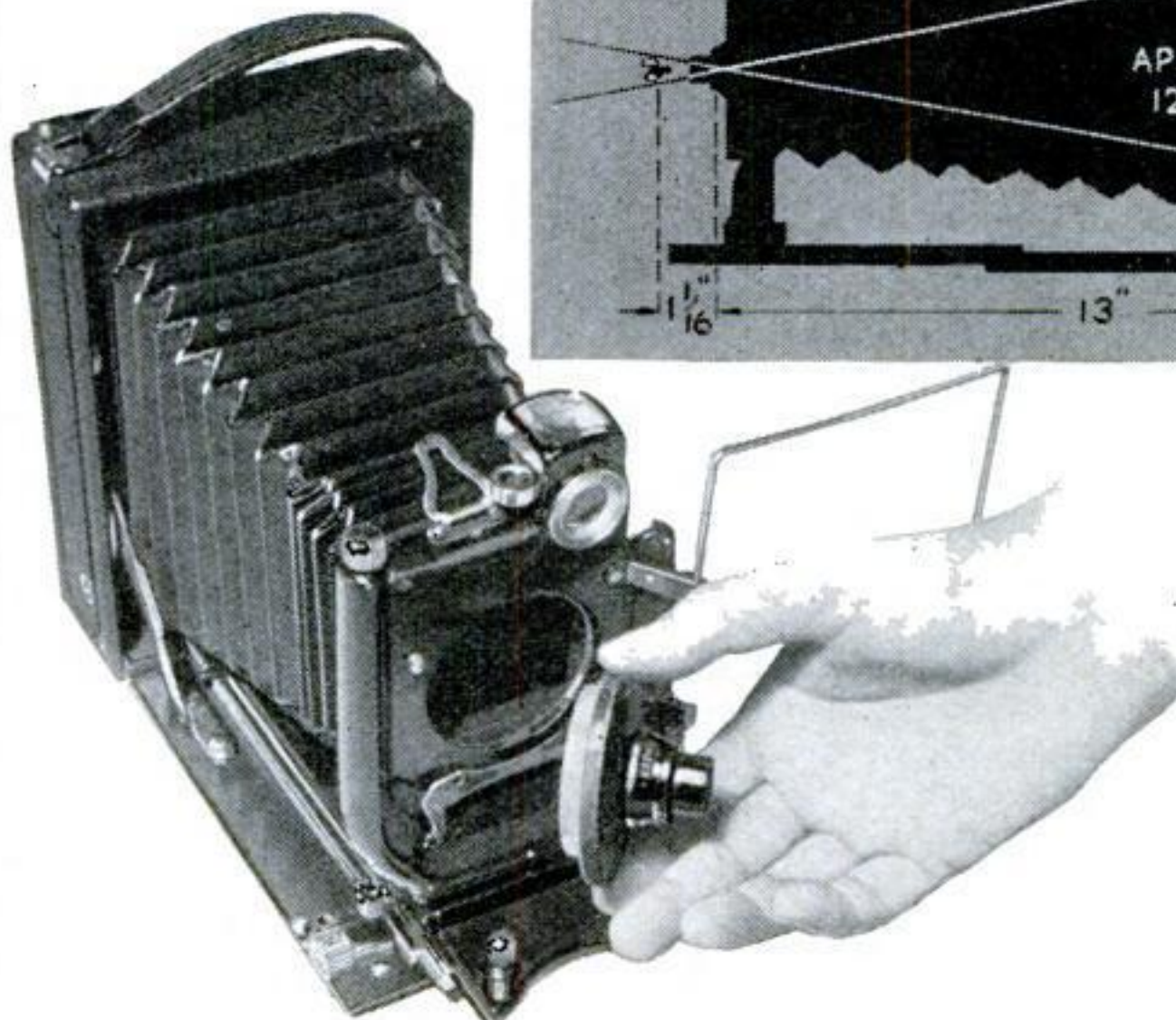
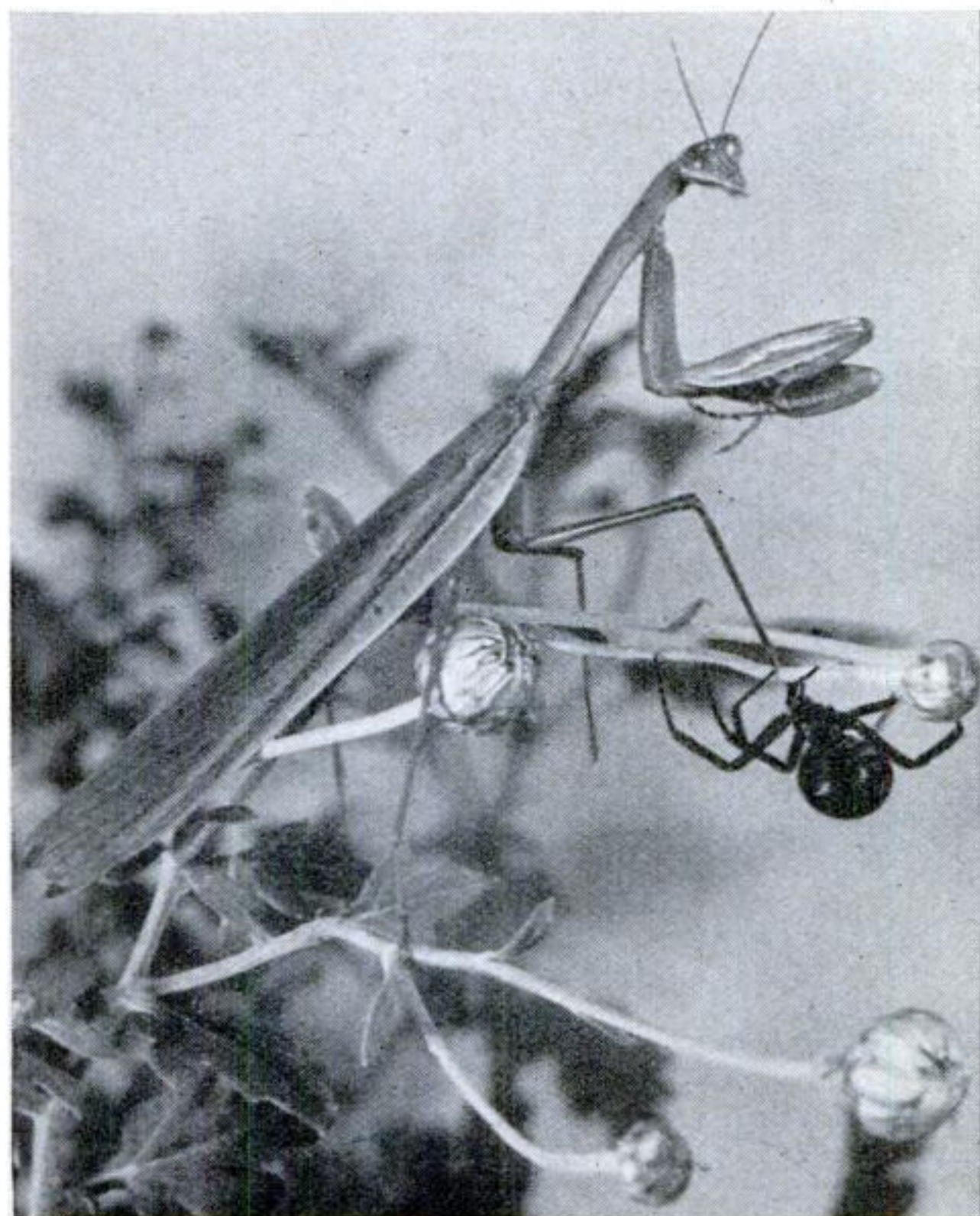
These tiny creatures affect our lives in a host of ways. Termites weaken our houses, gypsy moths strip our shade trees, farm pests destroy one tenth of all we raise. However, all the honey in the world, all the silk in the world, and all the shellac in the world come from insects. And, while they consume a tenth of our crops, without their aid in fertilizing blooms there might be no *(Continued on page 126)*



This six-inch Polyphemus moth is waiting for dusk to make its first flight. Doomed to die within a few days, it does not eat but lives on energy stored in its body

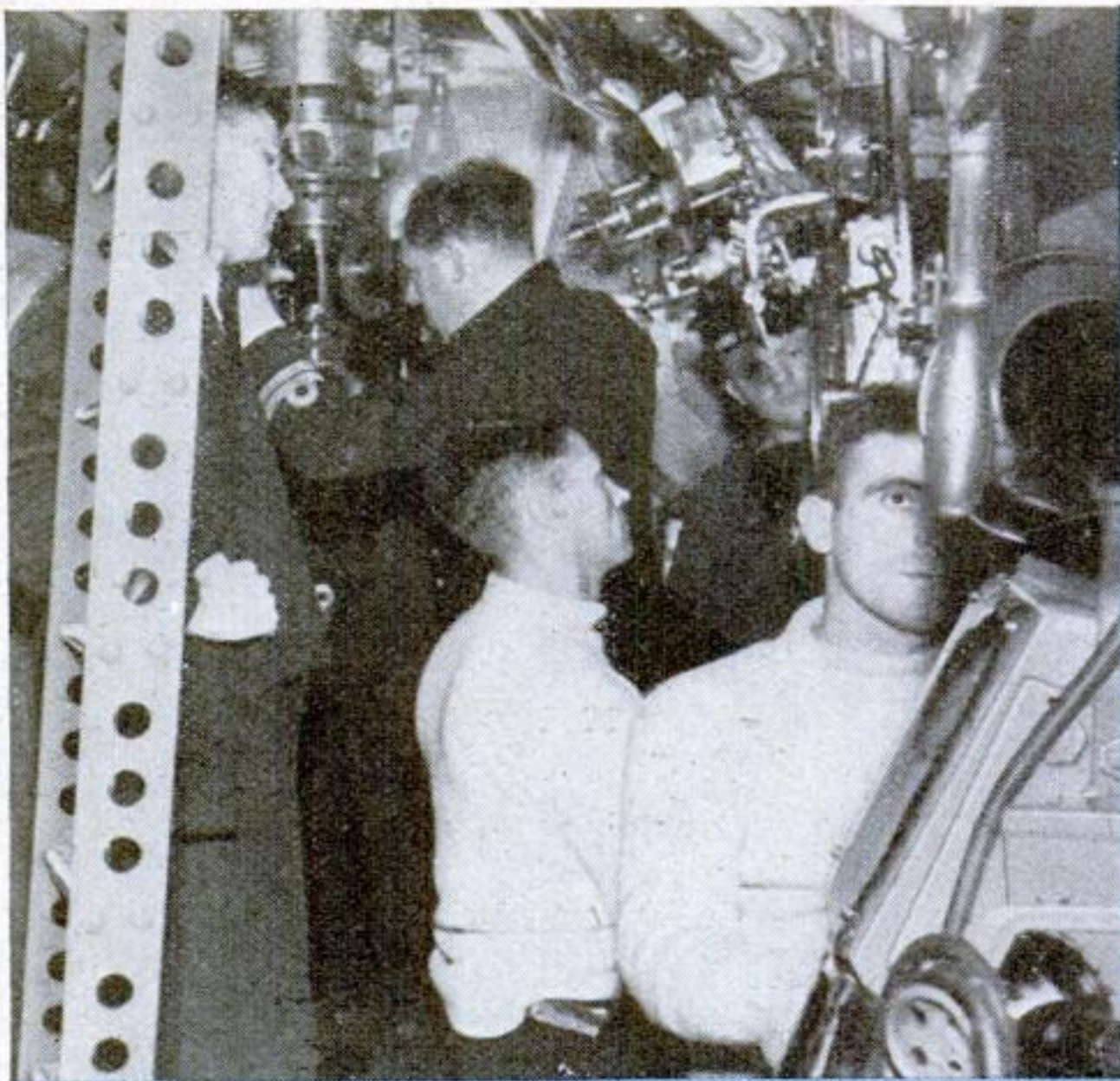


At the right, Teale's camera magic brings you face to face with an ant. Left, a life-and-death battle between a praying mantis and a black-widow spider. The spider lost

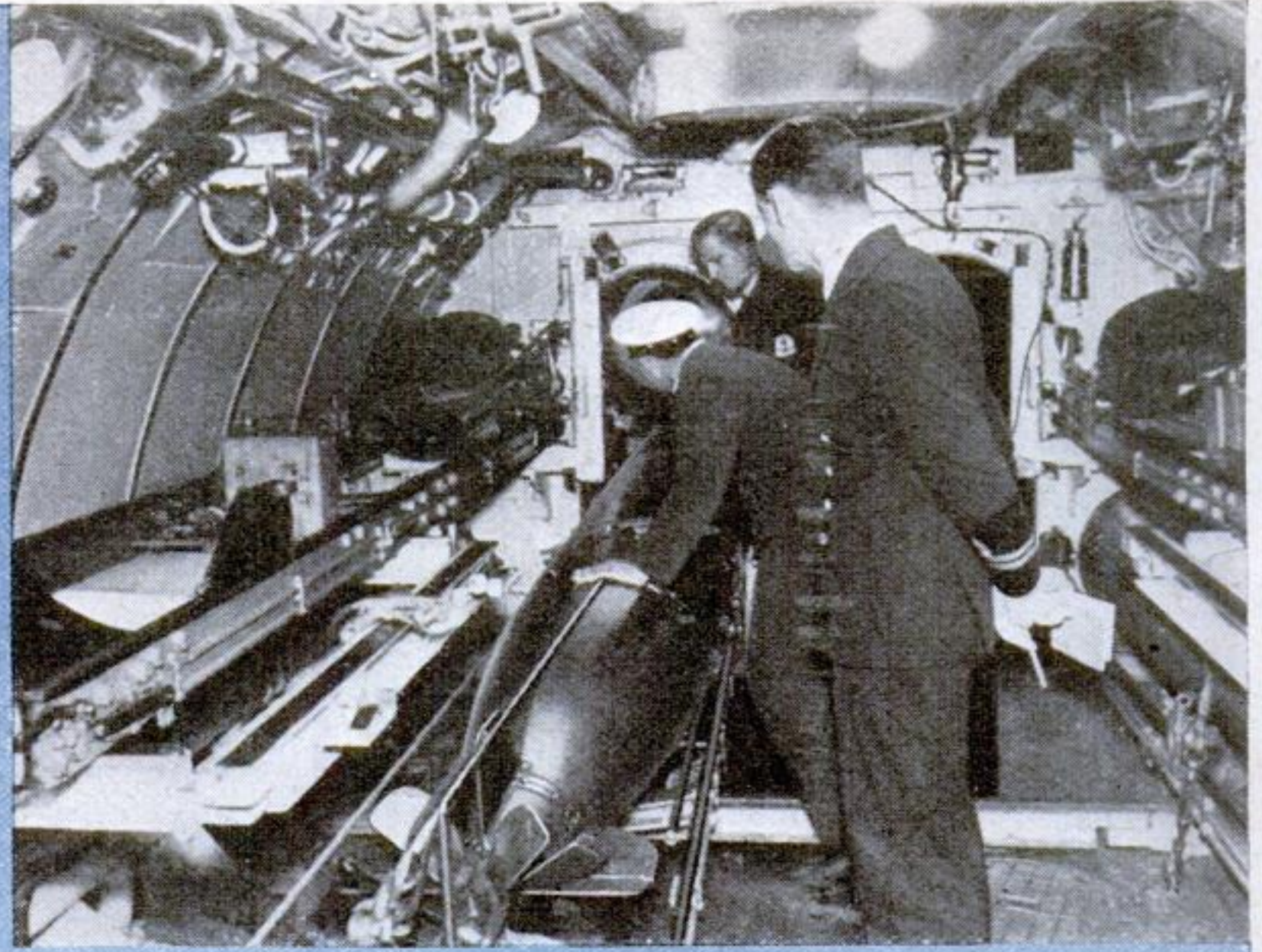


How a lens with a focal length of one inch, in a camera that has a double-extension bellows, is used to make the highly magnified pictures of tiny objects like the ant's head above





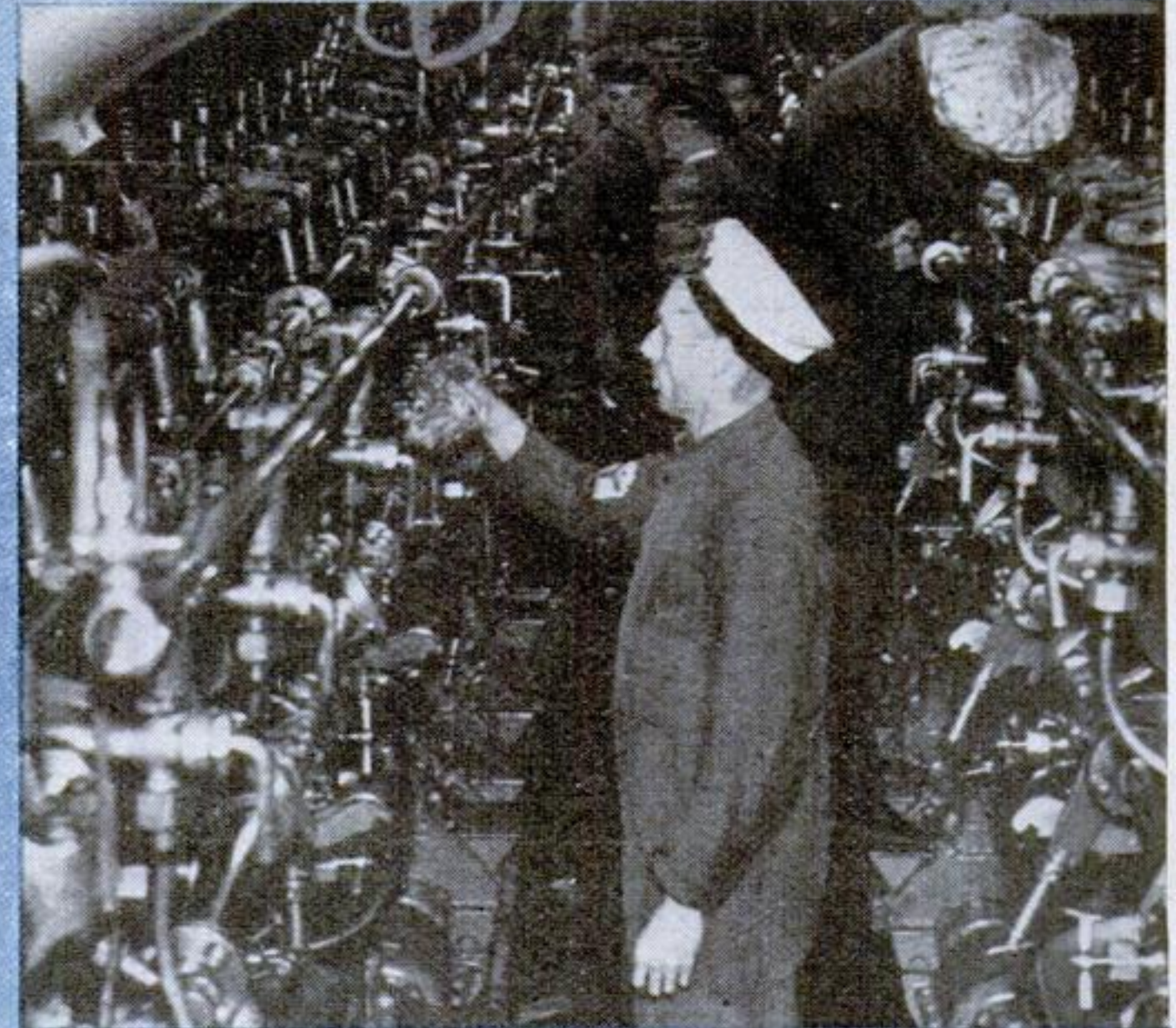
**AT THE PERISCOPE.** In the control room (see A in drawing) the commander, in left background, uses the "eye" of the submarine while aides direct the craft's movements



**TORPEDO ROOM.** Here (B in drawing) the submarine keeps its dreaded weapons. With the aid of steel cables, a torpedo is hauled to the slides and thrust home in the tube to wait for the target to be brought into line



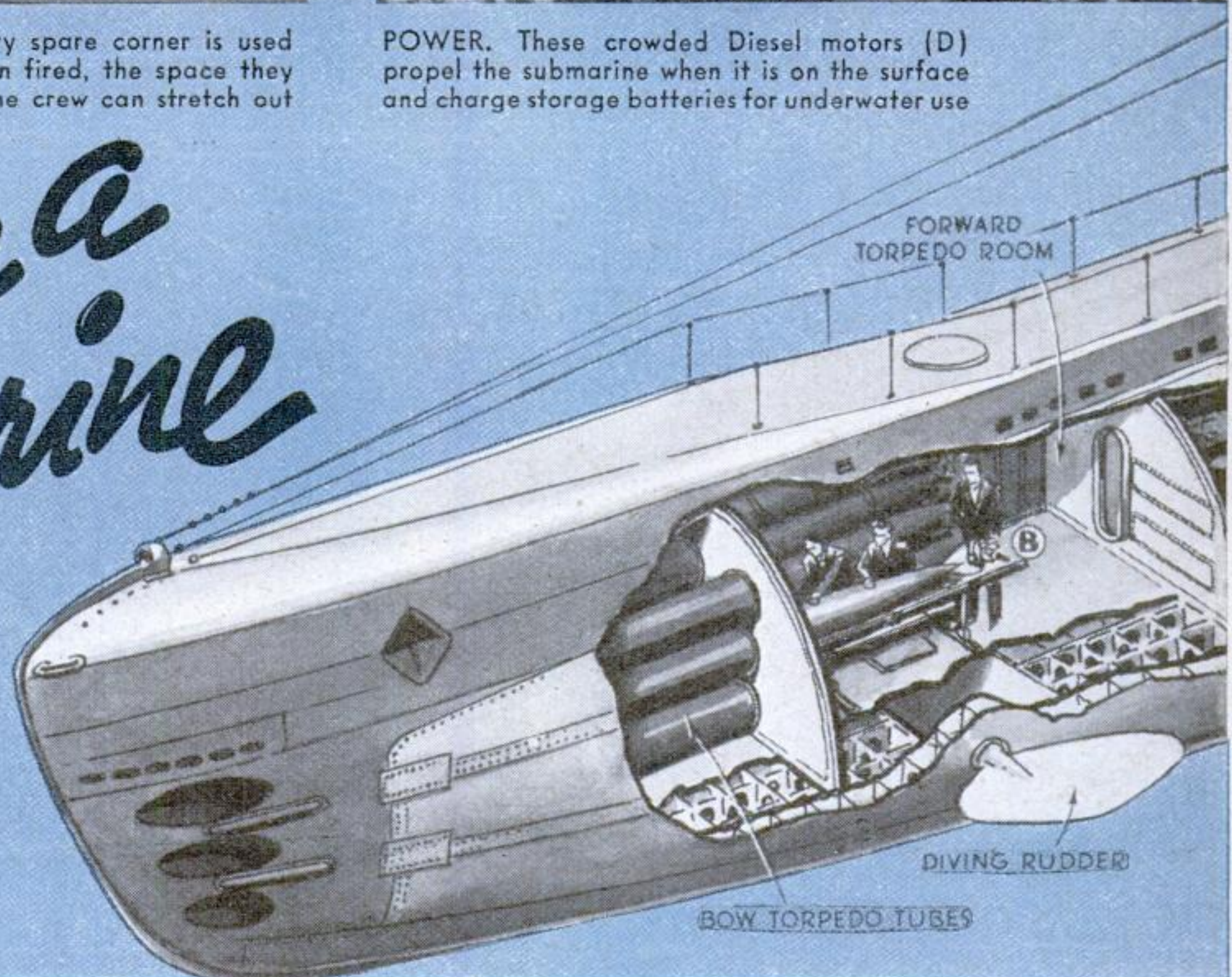
**NIGHTTIME.** For sleeping quarters (C), every spare corner is used for a bunk. When the torpedoes have all been fired, the space they occupied provides some extra room in which the crew can stretch out



**POWER.** These crowded Diesel motors (D) propel the submarine when it is on the surface and charge storage batteries for underwater use

# Life on a Submarine

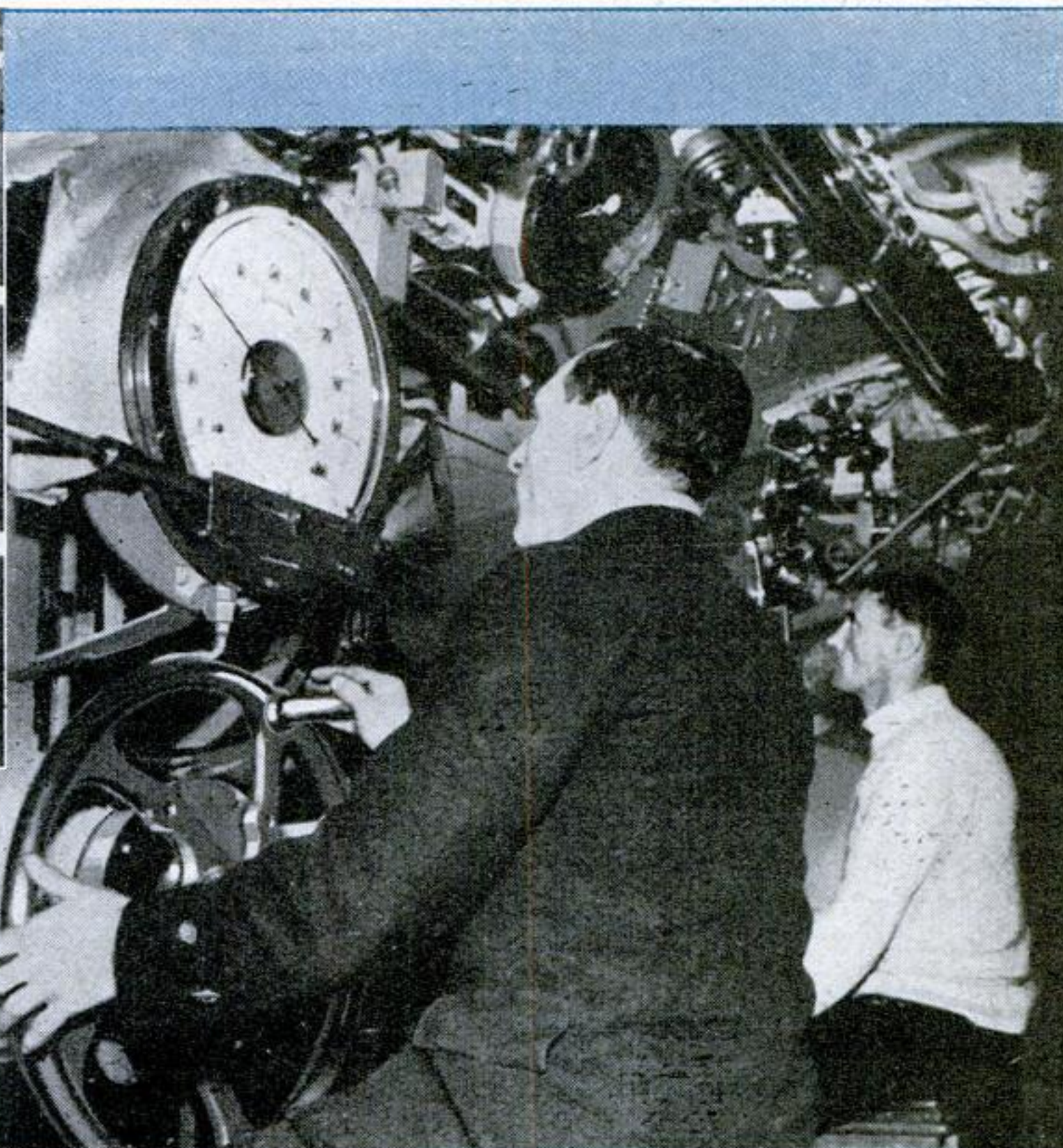
Forty-eight men live aboard a small submarine like the one at the right. Typical quarters are shown in the accompanying photographs, made by special permission on a British undersea craft



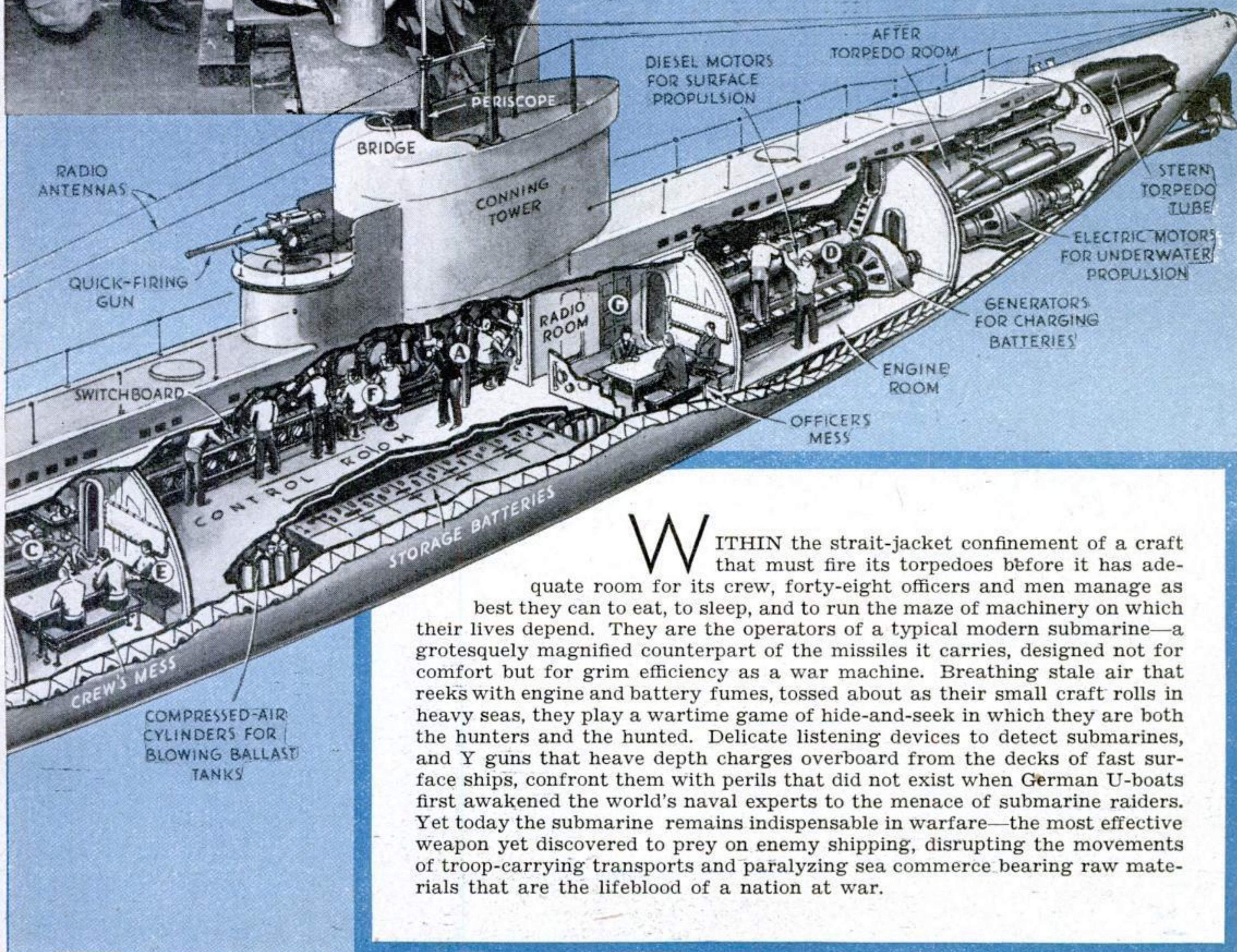
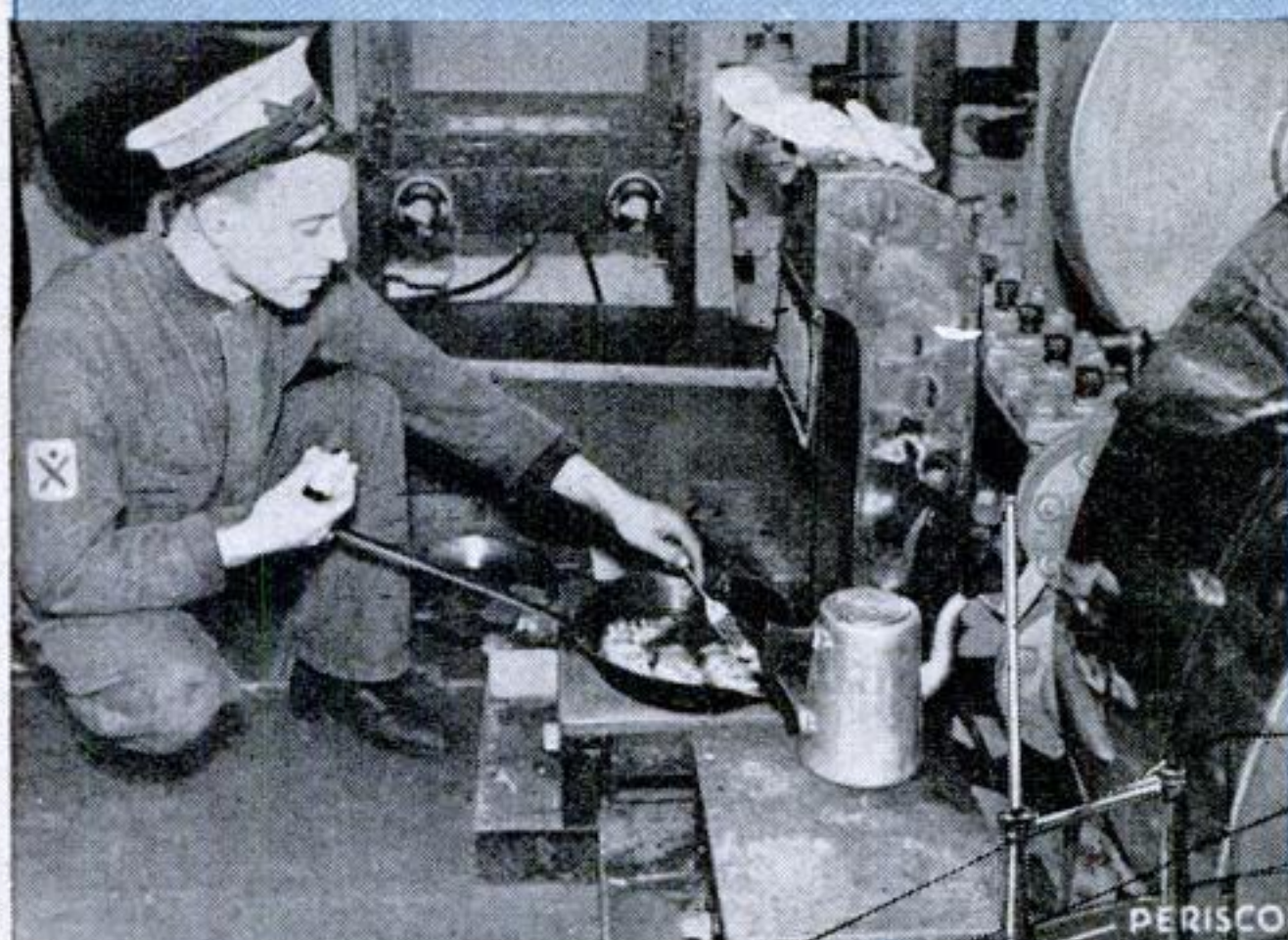




MEALTIME. With bunks folded back out of the way, the crew's quarters become a mess room. The officers' quarters (E) serve similarly for both eating and sleeping



DEPTH CONTROL. These men are operating the wheels and levers (F) that move the diving rudders to send the ship up or down, or to keep it on an even keel. The large dial shows how many feet the craft is beneath the surface. At the left is the tiny galley (G) with its electric stove



WITHIN the strait-jacket confinement of a craft that must fire its torpedoes before it has adequate room for its crew, forty-eight officers and men manage as best they can to eat, to sleep, and to run the maze of machinery on which their lives depend. They are the operators of a typical modern submarine—a grotesquely magnified counterpart of the missiles it carries, designed not for comfort but for grim efficiency as a war machine. Breathing stale air that reeks with engine and battery fumes, tossed about as their small craft rolls in heavy seas, they play a wartime game of hide-and-seek in which they are both the hunters and the hunted. Delicate listening devices to detect submarines, and Y guns that heave depth charges overboard from the decks of fast surface ships, confront them with perils that did not exist when German U-boats first awakened the world's naval experts to the menace of submarine raiders. Yet today the submarine remains indispensable in warfare—the most effective weapon yet discovered to prey on enemy shipping, disrupting the movements of troop-carrying transports and paralyzing sea commerce bearing raw materials that are the lifeblood of a nation at war.



# Strange Jobs Pay College Bills



**U OF M**

**RACING PIGEONS** help many a young boy to get an education. Old Nick, a world-famous bird, paid one student's way at the University of Minnesota. At the right, a Harvard student is making a little pin money by taking care of a baby while its parents take a night out



**H**

## FIRE-FIGHTING

For serving in the local fire department, a trio of undergraduates at Massachusetts State College get free rooms and kitchen privileges at the town fire house



**E**

**CATCHING SHARKS**, snakes, and other specimens for school laboratories is a meal ticket for James Mackay and W. B. Baker, Jr., at Emory University, Georgia

**B**ARBERS, boxers, blood donors, bouncers, carpenters, chauffeurs, chorus men, and cops—these names represent only a few of the thousand and one occupations by which students earn money to pay their way through college. Fully fifty percent of all the college men and women in the nation, according to a prominent student-employment expert, are reducing the strain on the parental pocketbook by earning all or part of their school expenses.

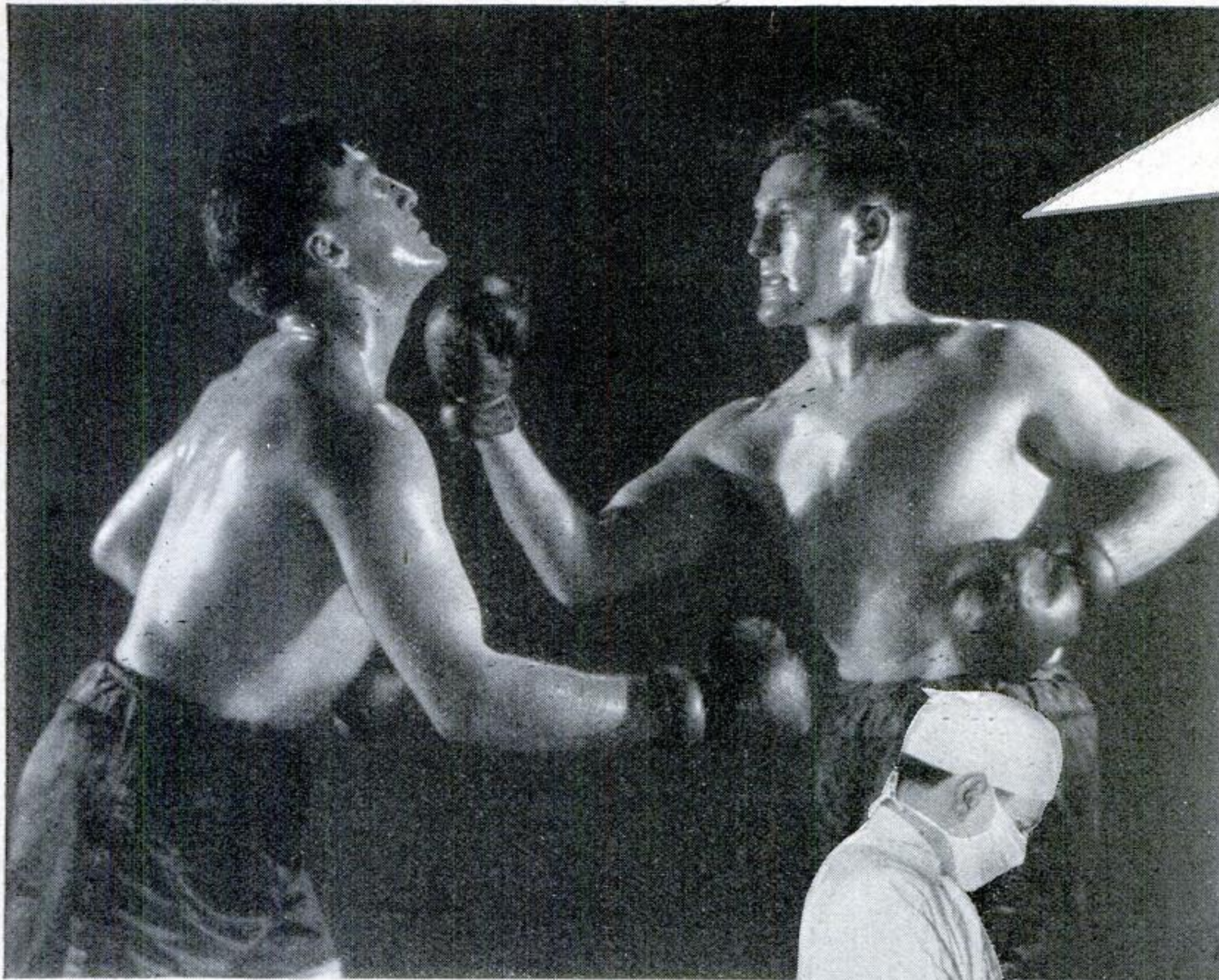
With competition keen in such conventional fields of student employment as selling magazine subscriptions and waiting on table, ingenious youths are constantly turning up novel methods of supplementing their income with jobs that run the gamut from minding infants to digging graves.

Two California undergraduates, for example, milked rattlesnakes to meet their university bills. Snaring the reptiles on trips into the mountains, they housed and fed them in an abandoned water tower, and at intervals extracted their venom for sale to laboratories manufacturing snake-bite serum.

In Minnesota, Leonard H. Murray paid his expenses for a year at the state university with the prizes won by Old Nick, a four-year-old pigeon which he had trained and entered in cross-country pigeon derbies.

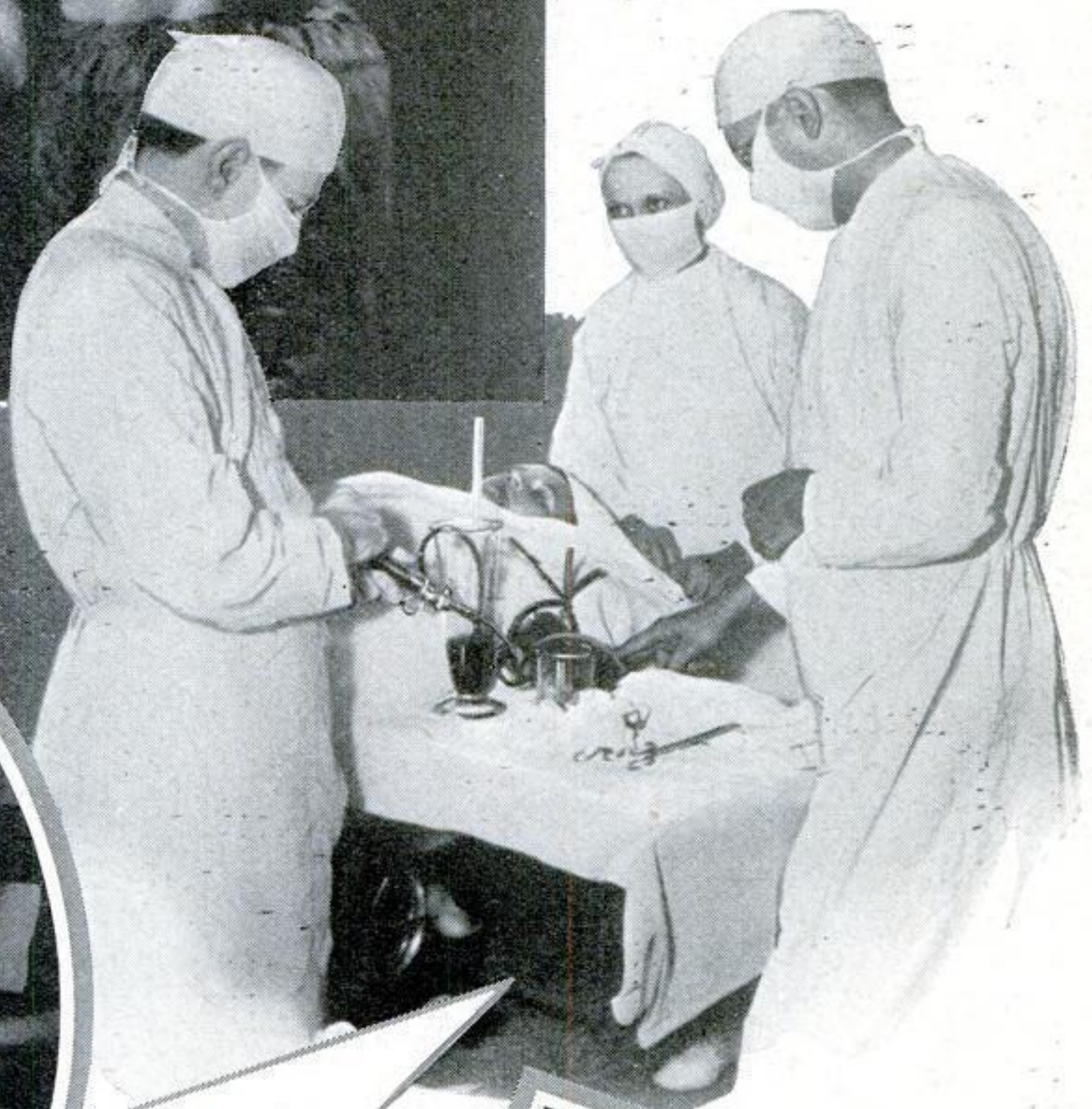
Many students pad their purses by acting as human guinea pigs in psychological, medical, and physics laboratories. One man spent many profitable hours basking under a battery of ultra-violet lamps to aid a scientific study of sunburn. Other odd college jobs are pictured on these pages.





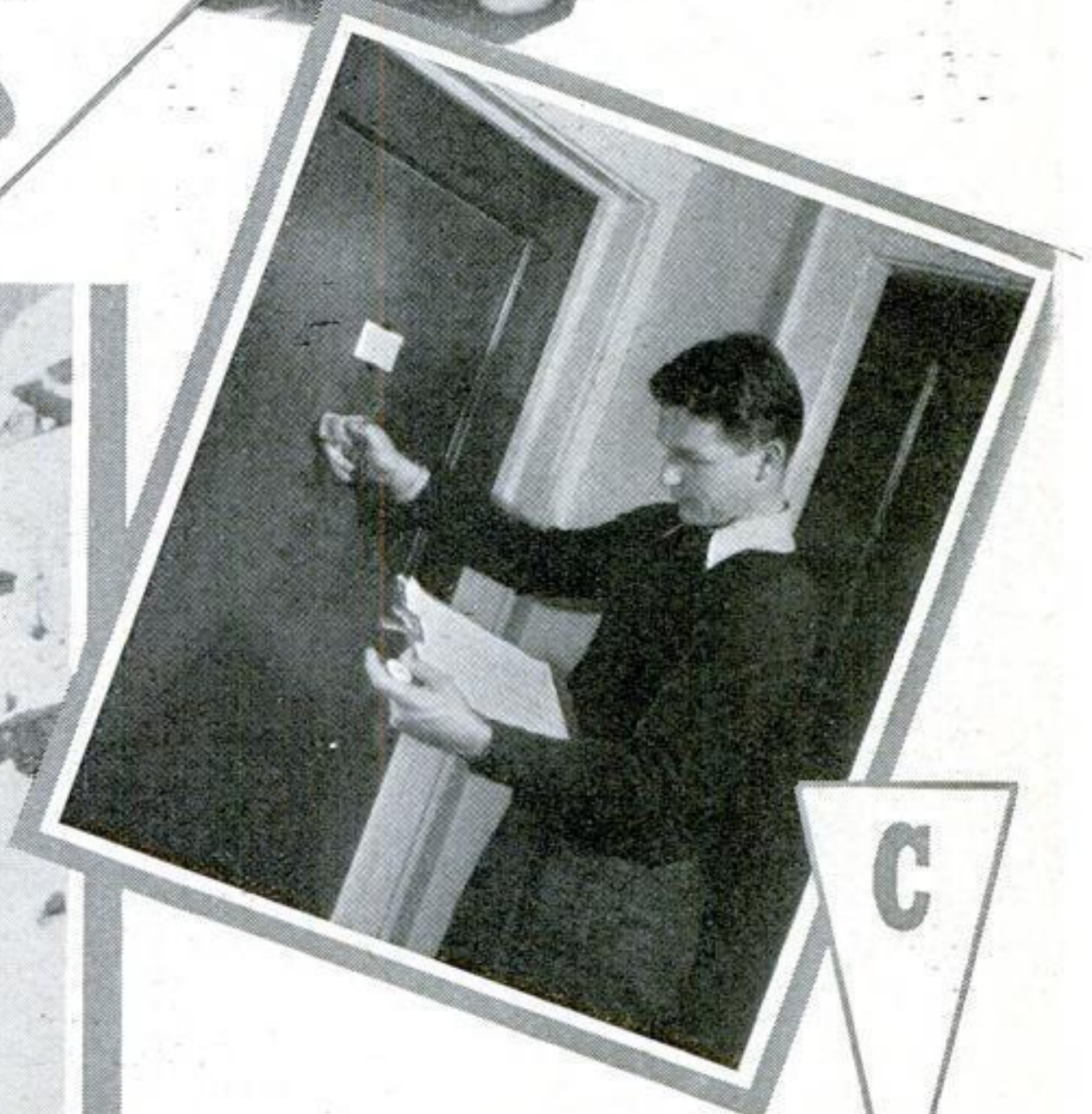
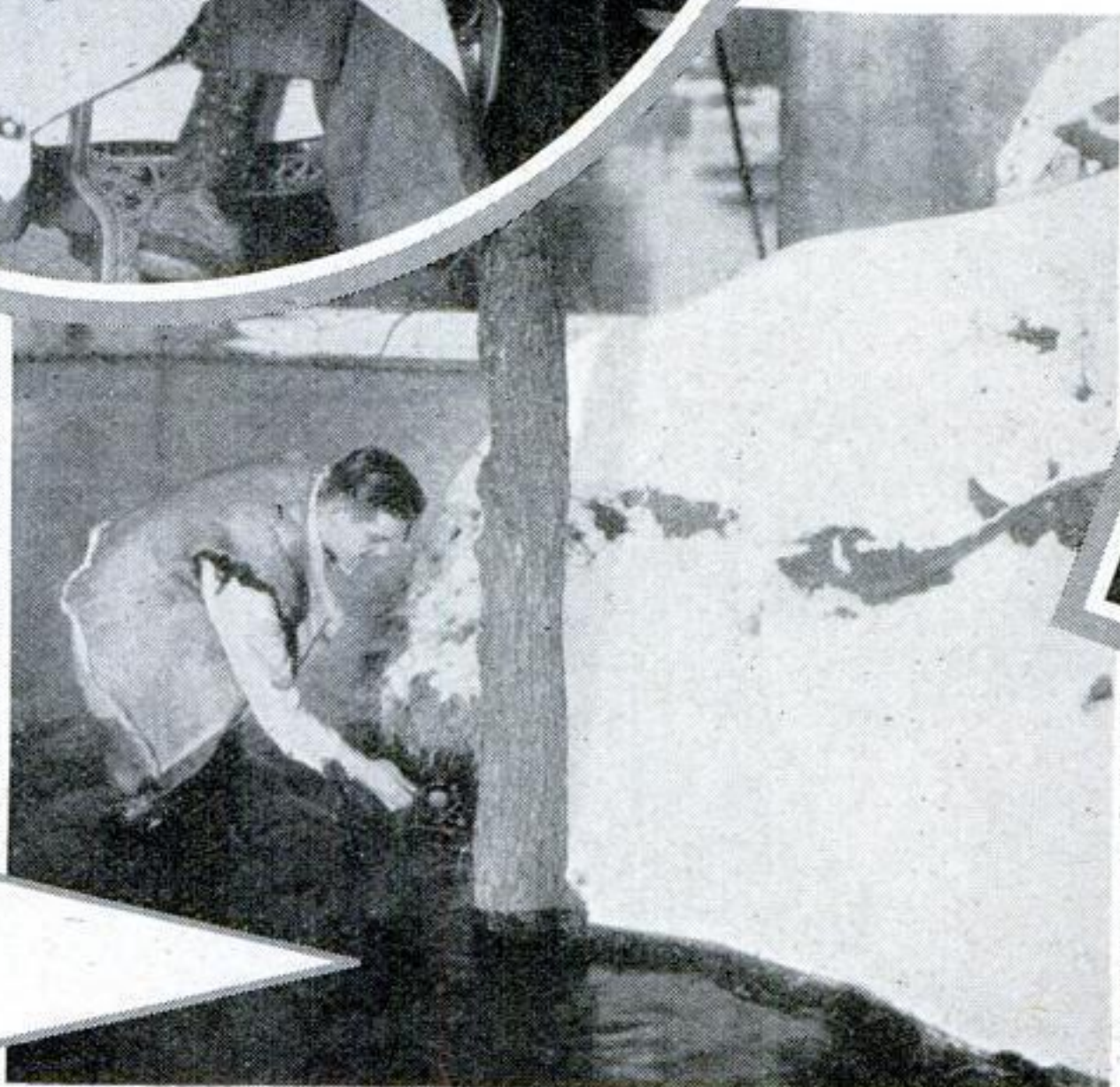
**BOXING** helps to pay college expenses for many students who go in for prize bouts, exhibitions, and club entertainments. Wrestling, too, offers a profitable side line to grappling with problems of higher learning

**BLOOD DONORS** are numerous among college men. Hospitals are always on the lookout for healthy specimens whose blood is of a type suitable for use in transfusions. Students also earn money by hiring themselves out to research scientists as human guinea pigs for all sorts of experiments



**BARBERING** gives these University of Washington undergraduates, Earl Snippen, Clifford Benson, and Oscar van Renterghem, a short cut to an education

**TRAPPING** was the way Eldson Staller, of Mexico, Ind., made his way at Butler University in Indianapolis. He had his trap line along the canal that runs past the university campus



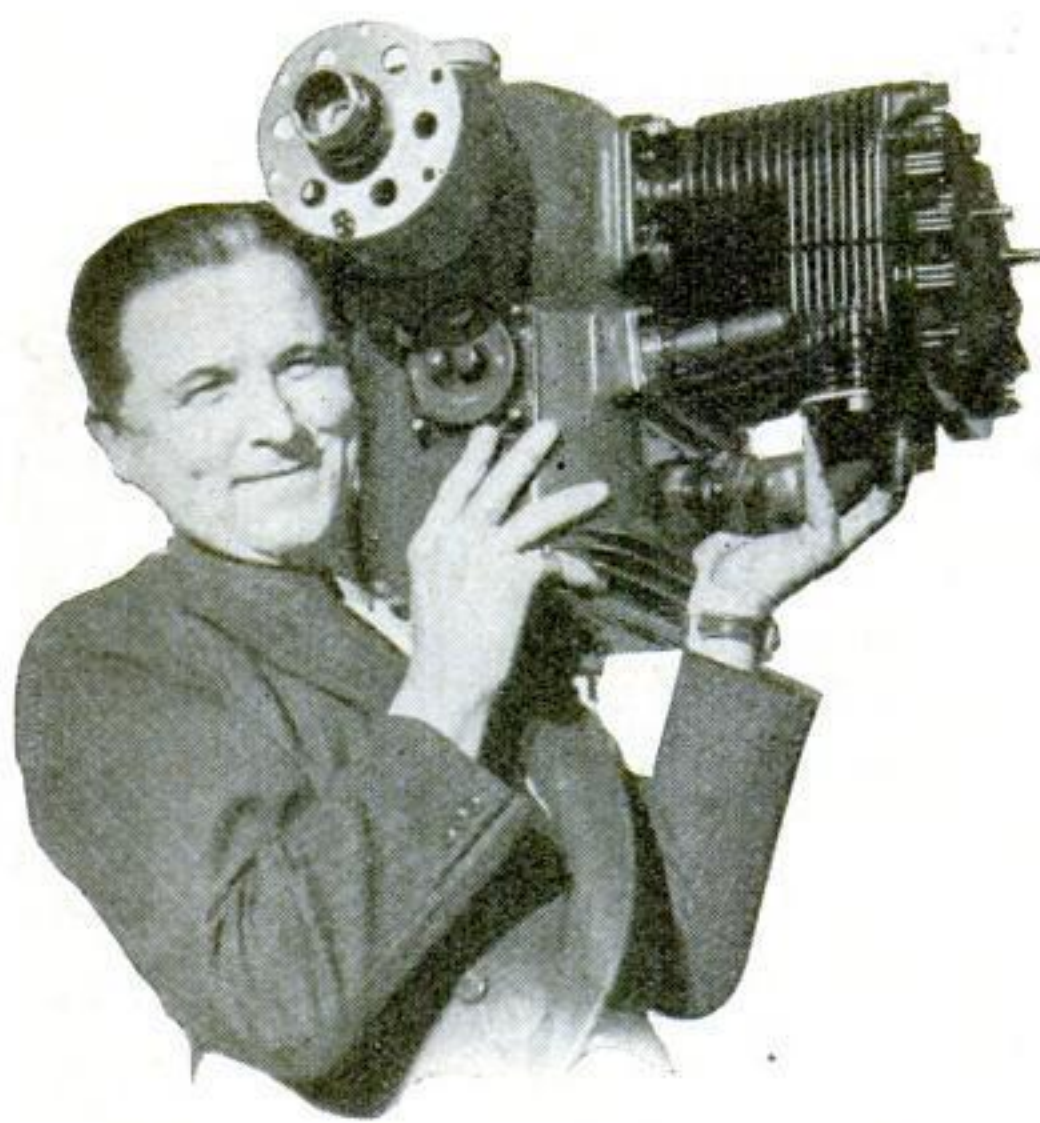
**WAKER-UPPER.** At Columbia, an enterprising student undertook to waken classmates at any appointed time—and also to make sure they got up





## Game Blends Croquet and Golf

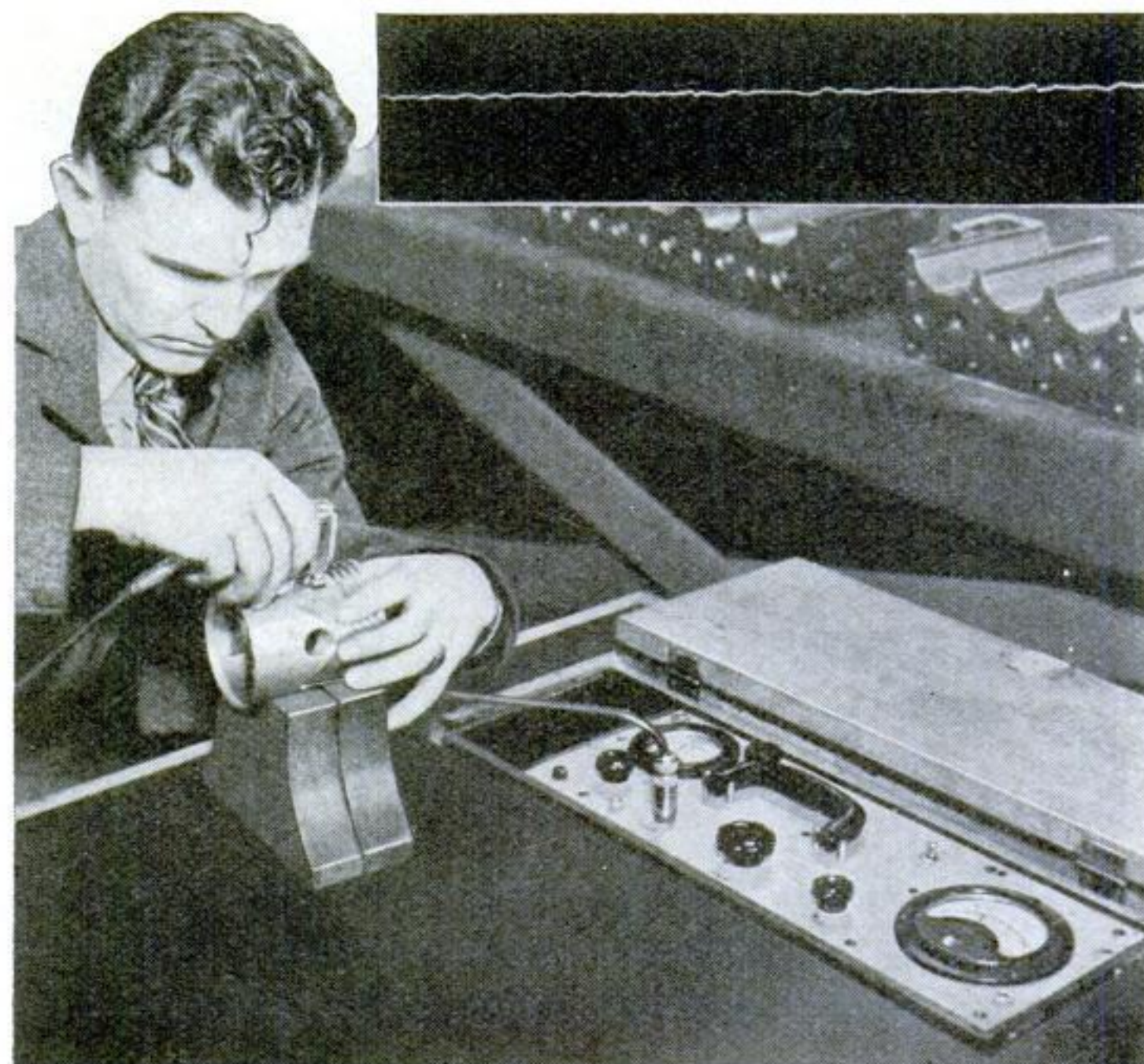
NICKNAMED "crolf," a new game that is gaining popularity at southern beaches and resorts combines features of croquet and golf. The game is played with regulation golf clubs and balls on putting greens. Four sets of croquet wickets placed around each hole on the course serve as hazards through which a player's ball must pass before it drops into the cup. In the photograph reproduced above, two "crolf" enthusiasts are seen in a critical moment of play, with their caddy looking on.



## Plane Engine Is Light

AN AIRPLANE engine that weighs about the same as the average airplane pilot has just been developed as a power plant for small, lightweight planes. The "featherweight" motor, shown above being held on the shoulder of its designer, tips the scales at 156 pounds.

TOO SMALL to be detected by a microscope, irregularities in the polished metal surfaces of automobile-engine parts are accurately measured with an extremely sensitive instrument developed by Dr. Ernest J. Abbott, of Ann Arbor, Mich. When a diamond point many times sharper than the finest needle is guided over a metal surface, its vertical movement in and out of the minute depressions creates an electric current that produces an oscillograph wave picture of the surface contours.



The profile tester in use, and its wave picture of a metal surface



## Musical Score Sent by Radio

WHEN the score of an unpublished symphony by the Finnish composer Jan Sibelius was lost in transit to the United States from Germany, a facsimile of a copy was radioed to Massachusetts in time for a scheduled performance. This is believed to be the first wireless transmission of a musical score in history.

## Heater Warms Boat Cabin

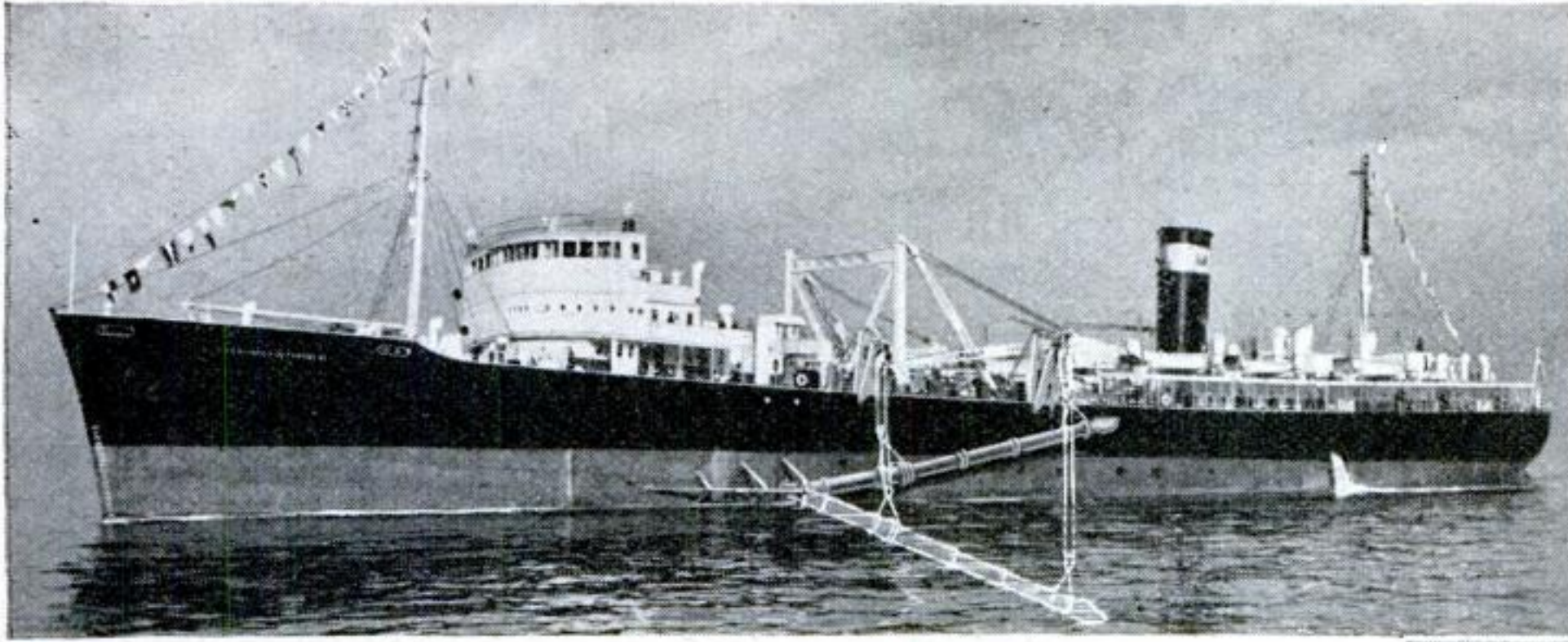


Yachtsmen can keep warm with this compact heater

A HANDY accessory for boat owners who encounter cold weather during trips made in the early spring is the small cabin heater shown in the photograph at the left. Scientifically designed to radiate a maximum of warmth, the device uses canned solid fuel. The metal unit is sturdily constructed and is finished in contrasting shades of enamel paint.

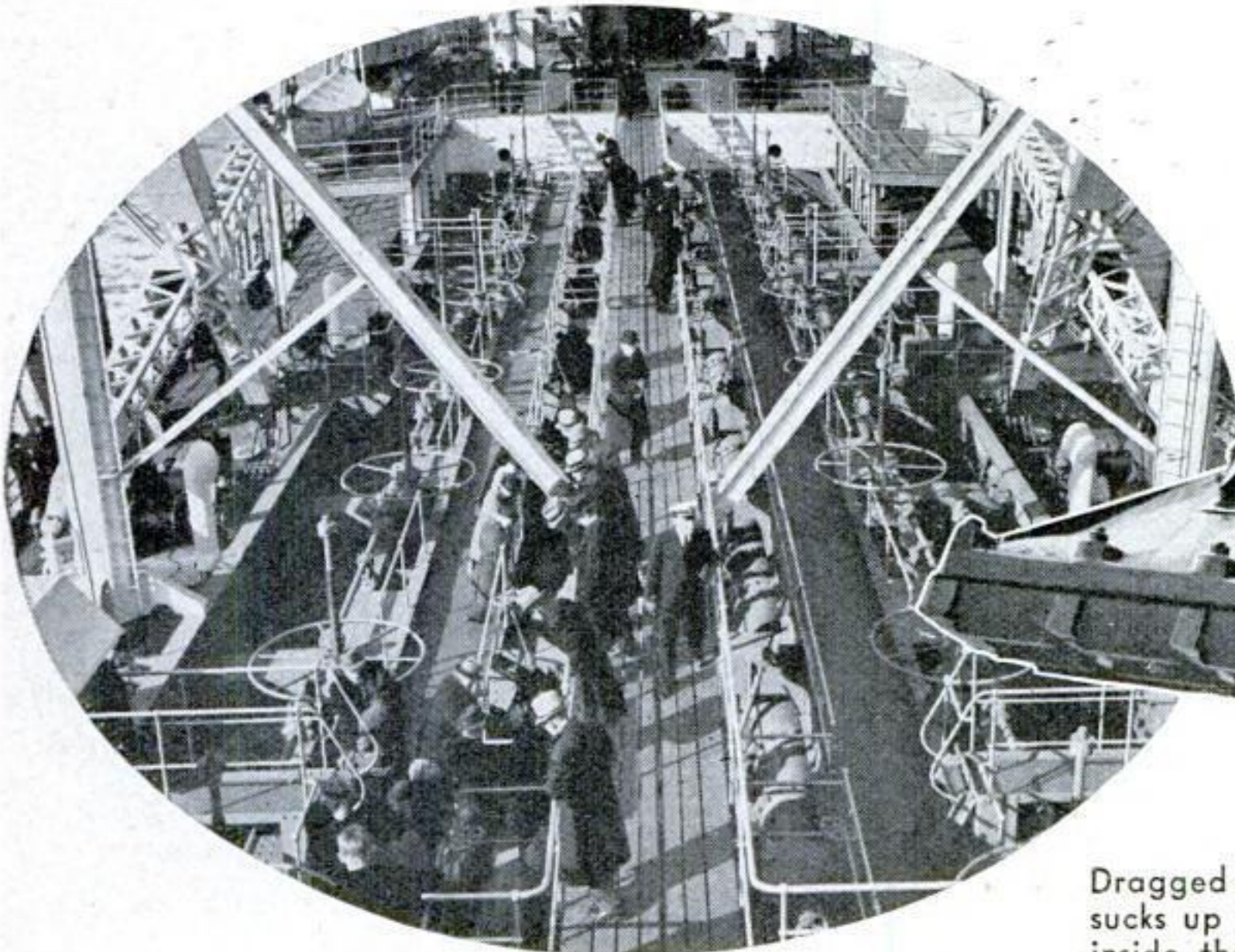
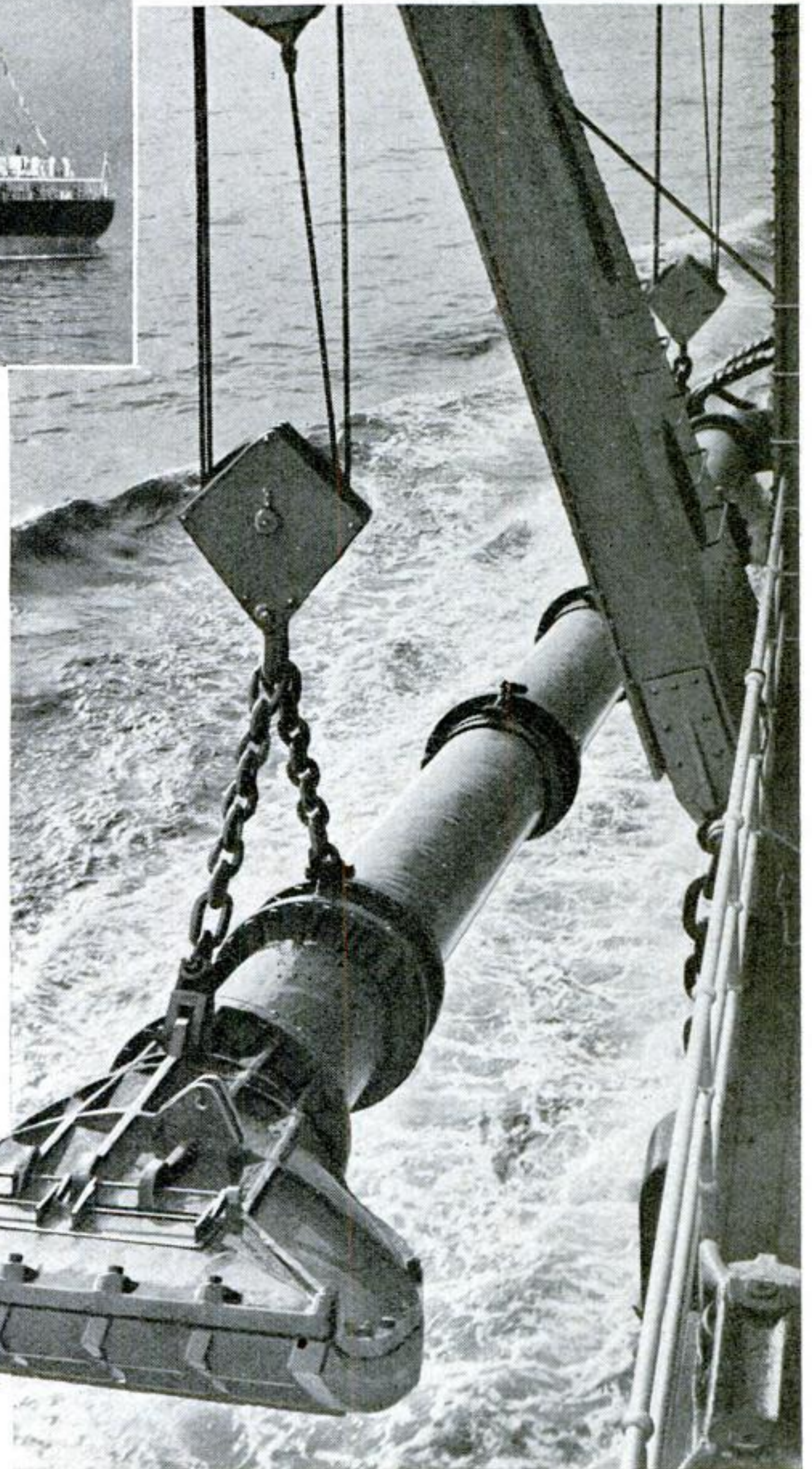


# New Dredge Ship Has Huge Vacuum Sweeper



The "Goethals," world's largest dredge ship, just put into service by the War Department

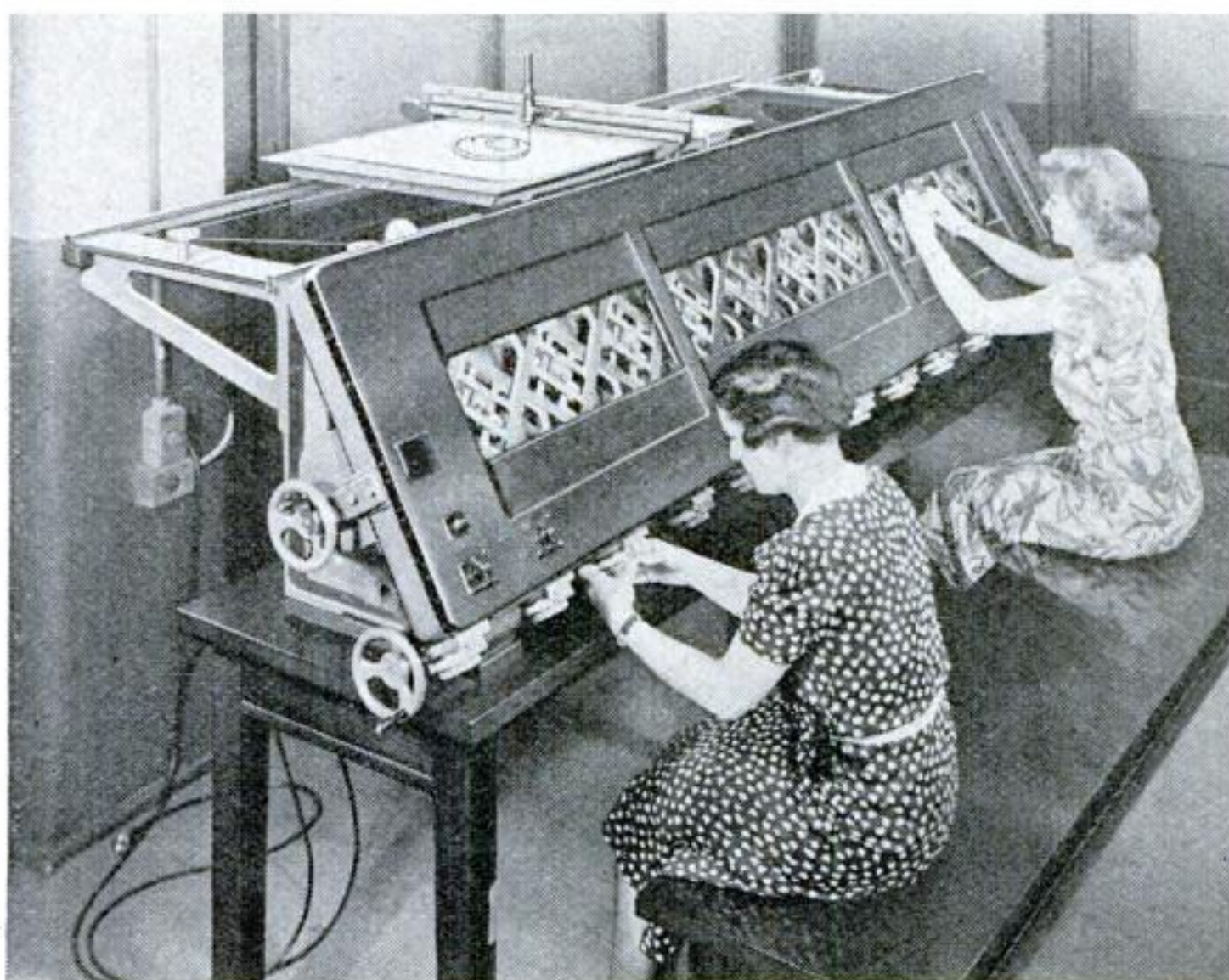
S AID to be the largest in the world, a new dredge ship has just been placed in service under the direction of the U. S. War Department. Named the *Goethals*, the \$3,500,000 vessel is 476 feet long and has a loaded displacement of 15,500 tons. In action, a giant "vacuum cleaner" sucks up silt and sand from the bed of a channel and pumps it into bins within the ship's hull. When fully loaded, the dredge steams out at ten knots into deep water, where motor-operated gates open to dump the load into the ocean. Manned by a civilian crew of eighty-two, the dredge ship has just started a two-year job of removing 15,000,000 cubic yards of fill from one of the channels in New York Harbor.



Dragged along the bed of a ship channel, this giant vacuum sweeper sucks up silt and sand from the ocean floor and pumps it into bins inside the ship's hull. Left, a view of the deck of the odd vessel

## Giant Calculator Solves Telephone Problems

AUTOMATIC solution of involved mathematical equations, necessary in determining theoretically the operation of certain electrical circuits, is accomplished by a unique mechanical brain constructed by scientists at the Bell Telephone Laboratories in New York City. Called an isograph, the giant calculator is capable of solving in one day intricate problems that previously required four. Electrically driven, the unit is a maze of intricate mechanisms.



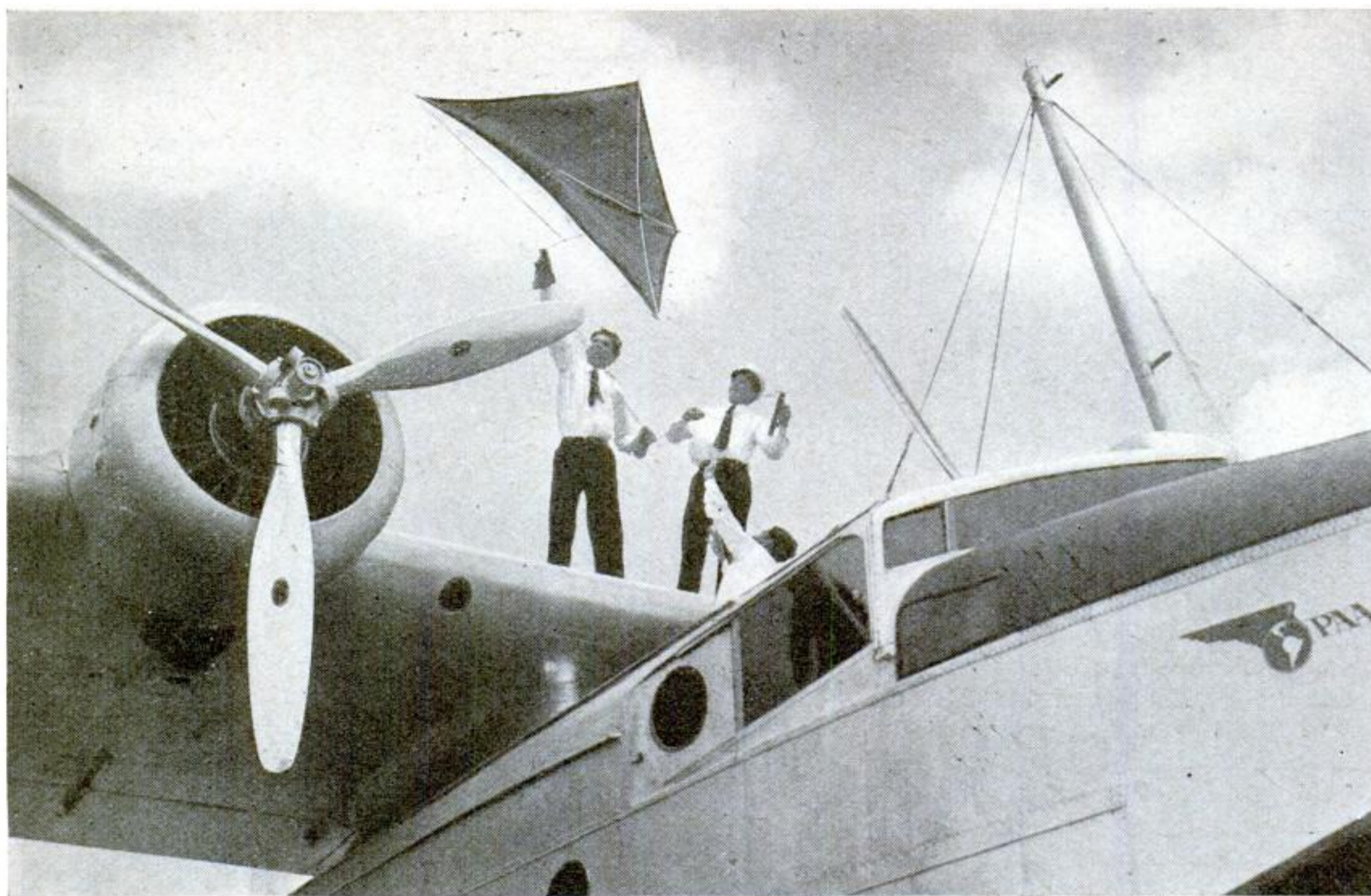
Girls operating the "isograph" to solve mathematical equations



## Smokers Get Ash Tray To Carry in Pocket

AN ASH tray for cigarettes, just introduced, is small enough to carry in a vest pocket. When a button is pressed, spring hinges flip open a part of the container's cover to expose a receptacle for ashes and a handy cigarette rest, visible in the photograph above.





Pilots testing the kite that supports the antenna if a plane is forced to land on water

## Clippers Get Kite Antennas for Emergencies

CAPABLE of flying in winds that average only one mile an hour, a kite antenna recently developed by radio engineers has been installed on planes of a transoceanic air line as an emergency substitute for the regular trailing aerial, in case a ship is forced down at sea. Stored in a compact cylindrical case, the kite can be quickly assembled from aluminum-alloy tubing, red airplane fabric, and rustless wire that serves as the kite's tail as well as the emergency aerial. Fed out on a fifty-foot control line, the six-foot kite is said to be able to fly even in a tropical calm or during a heavy rainstorm.



This folding desk is made of composition board

## Snakes Hiss and Rattle for the Radio

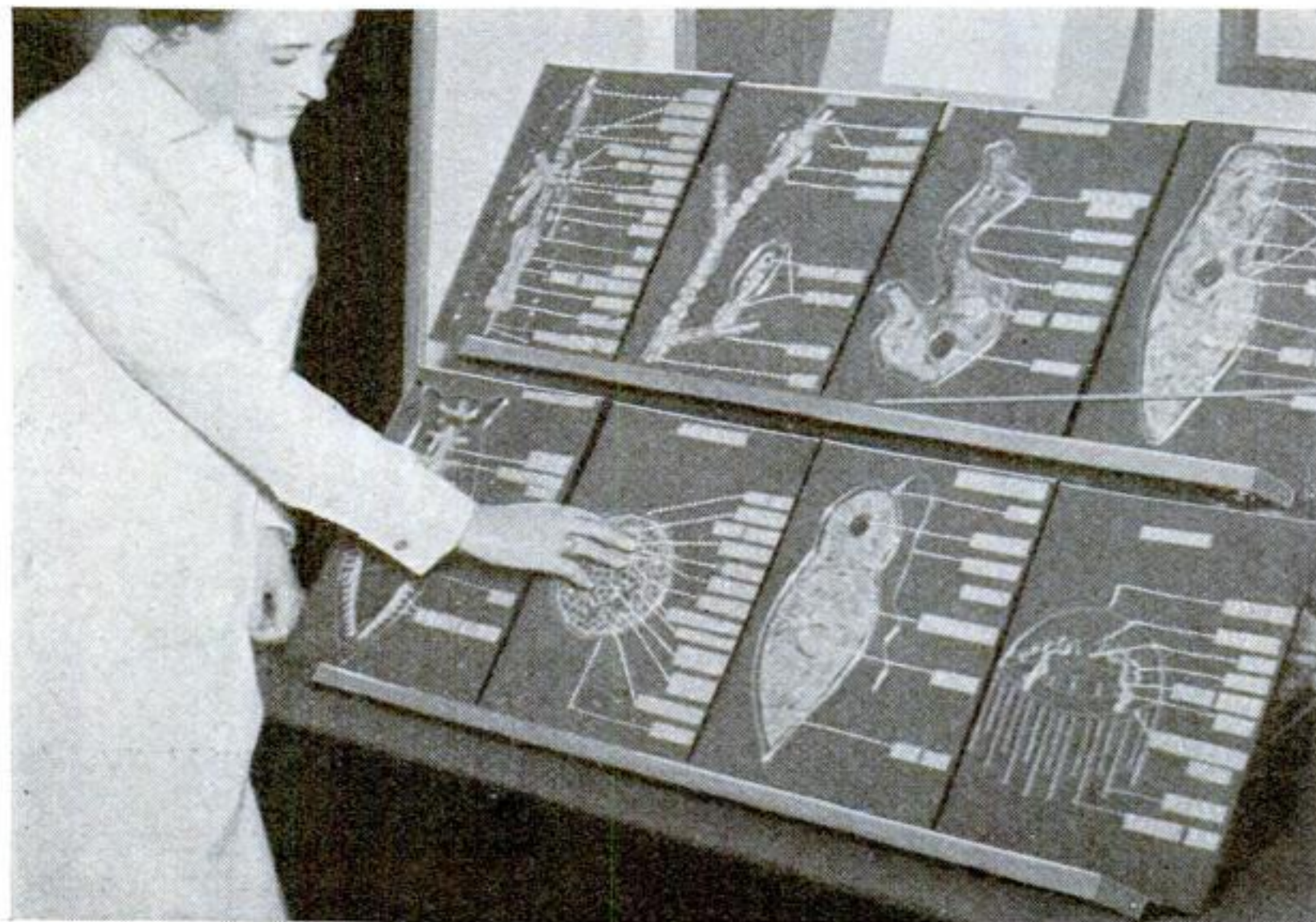
NOISES made by snakes were the feature of a recent radio broadcast sponsored by the University of Illinois. In the photograph reproduced at the right, J. S. Aversof of the Illinois Natural History Survey is shown standing by in case of an emergency as Francis X. Lueth, university student assistant, wrestles a three-foot prairie rattler up to take his turn at the microphone. A lecture on snakes accompanied the radio appearance of the reptiles, whose hisses and rattles, listeners reported, sounded much like the crackling and sizzling of steam escaping from a faulty radiator.



A prairie rattler at the microphone in a novel program

## Handy Desk Folds Flat for Storage

MADE of lightweight composition board set in a wooden frame, a handy desk for offices, and for small homes and apartments, folds flat when not in use. Although the compact desk provides storage drawers, and sufficient table space for writing, typing, or clerical work, it can be folded and tucked away in a closet.



Raised models and Braille legends replace microscope study for the blind

## Blind Students 'See' Tiny Cells in Wire Models

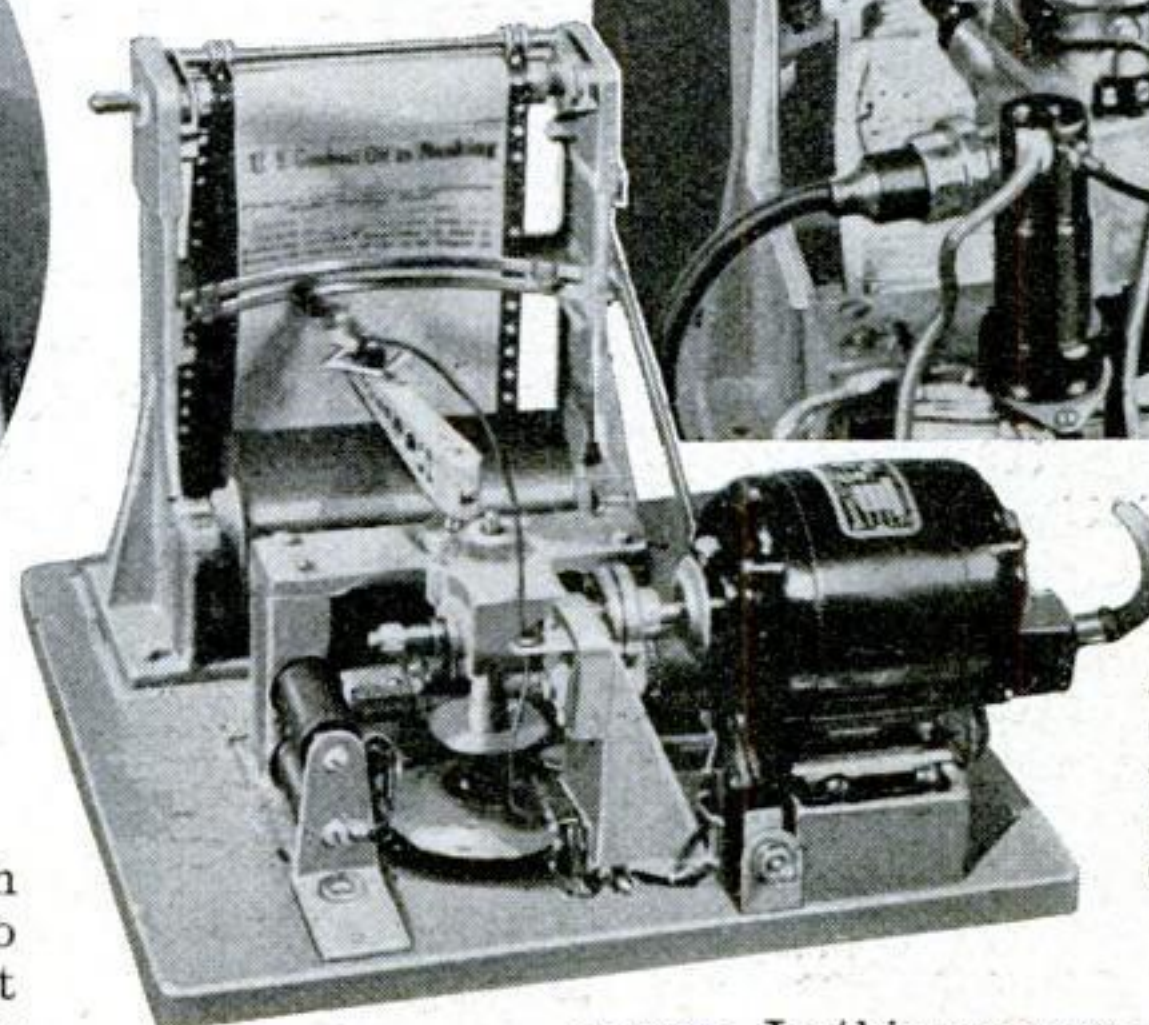
SO THAT blind biology students at the University of Pittsburgh may "see" animal life in the microscopic world, models of amoebas, parameciums, and other tiny specimens are made of wire, tacks, and bits of metal fastened to boards. Reading names of cell parts in Braille characters, students follow raised lines of kinked wire to the parts named. Students learn how the various forms of life are constructed, by running their fingers over the models.



# Radio Newspaper Service Gets Test In The Home



Left, reading the radio newspaper. Right, the electric eye that translates print into electrical impulses



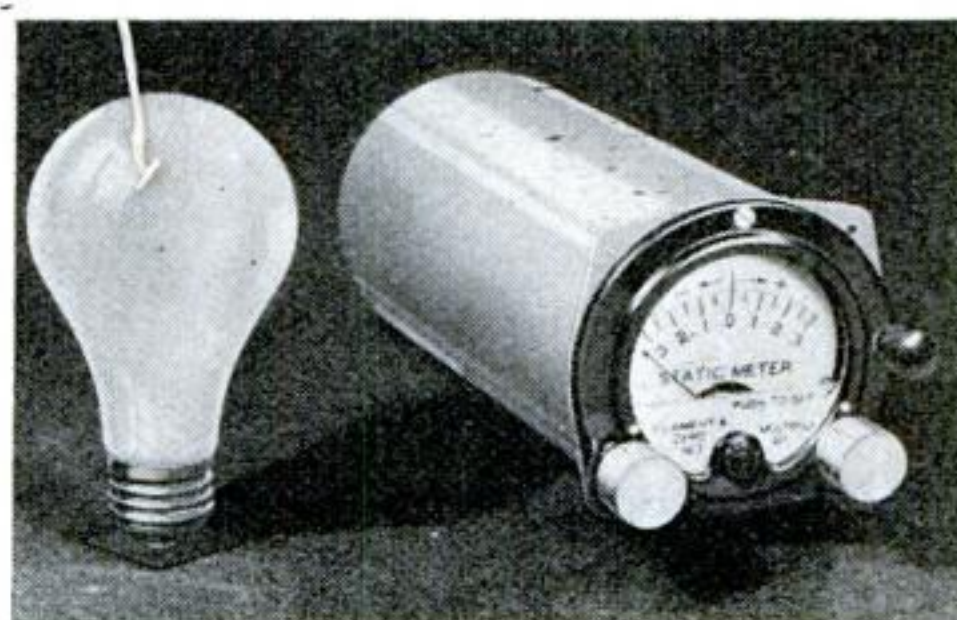
At the left is the receiving unit in which a stylus reproduces the print on a roll of paper

**P**RINTED newspapers emerge from compact units attached to conventional radio sets in a number of California homes where a novel type of radio news service is being tried out. At the broadcasting station, news flashes are compiled, edited, and printed during the evening. From midnight until morning, at periodic intervals, the printed news items pass before an electric-eye

apparatus which converts them into radio signals that are transmitted in the usual manner. Receivers, tuned to the sending station throughout the night, pick up the impulses and transmit them to the facsimile units where they actuate a stylus to print the radioed news on a moving strip of sensitized

paper. In this manner, the radio owner can have an up-to-the-minute summary of the latest news, printed on a long strip of paper, immediately upon arising in the morning. The sending and receiving units of the novel news-broadcasting system are pictured above.

## Tiny Meter for Planes Detects Static



Static detector compared with an electric lamp

**TO ENABLE** air lines to plot the location of troublesome static areas along their routes, a new instrument that detects and measures the volume of static will soon be installed on planes of a transcontinental system. Sensitive enough to detect small differences in the volume of the interference, the meter will permit pilots to give accurate reports on the static encountered when they radio weather data and their position at periodic intervals during a flight.



## Chairs Tailored to Fit for Greater Comfort

**CHAIRS** "tailored" to fit their owners are made possible by the invention of a measuring device for use by furniture dealers. When a prospective customer sits in the chairlike apparatus, as shown above, it is adjusted until its proportions give the maximum comfort. These measurements are then reproduced in the "tailor-made" chair.

## Cars Can Tow Cannons

**TAXICABS**, passenger automobiles, and trucks may be used to tow field guns, by the use of a new coupling device. It is said that a car can pull a 75-mm. gun at good speed along any passable road.

## Electric Unit Frisks Prison Mattresses

**"FRISKING"** mattresses used by prisoners, a portable electrical apparatus for prisons detects the presence of knives, revolvers, saws, or other metal objects hidden in the stuffing. The unit is plugged into an electric outlet and the mattress fed through it as through a wringer. When the balance of the unit's electric system is upset by the presence of metal, a bell rings to give warning.

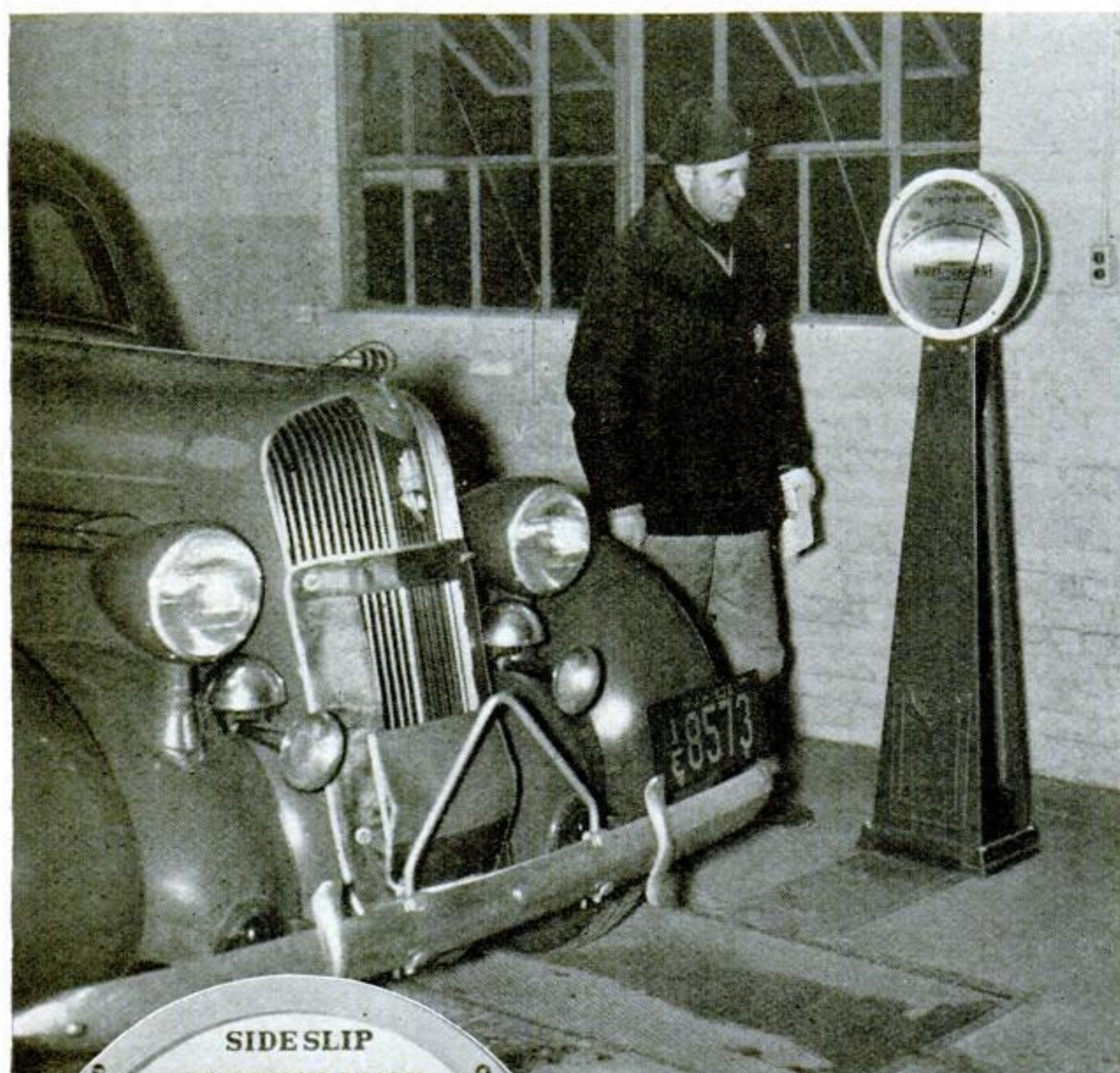
If the mattress contains any metal objects, a bell rings





# Is Your Car Safe To Drive?

...NEW TESTS CHECK DANGER SPOTS



REGISTRATION CERTIFICATE and license plates must be in order. Here a New Jersey inspector is examining a motorist's credentials before testing his vehicle



**WHEEL ALIGNMENT.** As a car passes over a set of metal plates, the amount of "toe-in" or "toe-out" of the front wheels is registered on a dial like the one at the left, which shows the number of feet of side slip to the mile



**WHEEL PLAY** at the front tire treads is limited to a quarter inch. While the ends of the car are jacked up, tests are made of shackles, exhaust, and other near-by parts

**C**HANCES are better than 54 to 100 that your car is not safe to drive. This startling fact is revealed by the results of compulsory motor-vehicle tests now being carried on throughout the State of New Jersey.

In twenty-eight elaborately equipped testing stations, automatic jacks pop out of the floor to raise a car for under-chassis inspection. Instrument dials connected to steel wheel plates tell instantly if front wheels are properly "toed." Photo-electric cells check the focus and angle of headlight beams. Columns of colored liquid rise in glass tubes to indicate braking power. In less than three minutes, trained inspectors put each car through an automotive third degree, checking everything from bumper to bumper and from roof to tire tread.

Data obtained from thousands of these New Jersey tests throw a spotlight on the danger areas that motorists in all states should check to make their own cars safe. Can you stop your car within thirty feet when driving twenty miles an hour? If not, your brakes are below the minimum safety standard and need adjustment. Even if they meet this test, are your brakes properly equalized? The most powerful brakes may be worse than useless if their unequal action pulls a car into a skid.

Motor-vehicle inspectors warn you to make immediate adjustments if there is more than two or three inches of play in your steering gear. If the steering knuckles are worn, replace them. If you can wiggle the front wheels more than a quarter of an inch by shaking them with your hands, they should be tightened. If they "toe in" more than one eighth of an inch, you're headed for trouble.

Delicate photo-electric apparatus checks the lights of New Jersey motorists, but you can make sure your own lights are safe for night driving by a





Motorists waiting their turn at one of the New Jersey testing stations. Owners must present cars once every six months for an inspection that covers everything from brakes to windshield

HEADLIGHTS are given the third degree by this testing machine, on which "electric eyes" gauge the intensity and focus of the beam from each lamp. You can make a similar test of your own car's headlights by laying out lines on a blank house or garage wall and throwing the lights upon it to see how the beams are directed

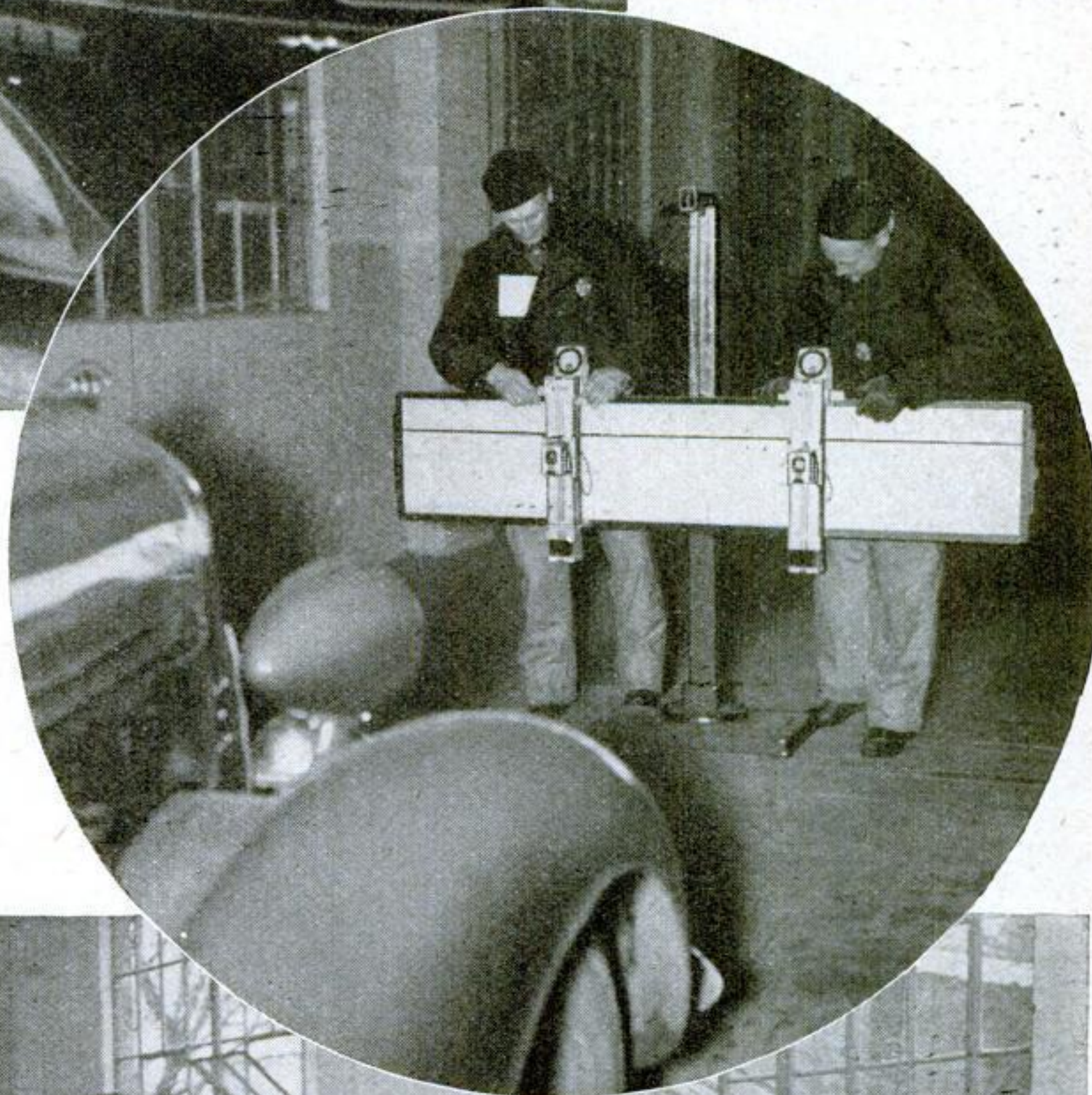
## By ARTHUR A. STUART

few simple measurements. But first of all, do all your lights actually light? Many a gruesome smash-up has been traced to a one-eyed car.

Shine your headlights on the blank wall of your house or garage and drive up until the lenses are exactly twenty-five feet from the wall surface. Draw a horizontal line on the wall at the precise level of the centers of the lenses. Then adjust your lights so that the beams do not spread higher than one inch nor lower than four inches from the line. If the beams aim more than five inches to the right or left of the center lines of their respective lamps, they should be centered. And while you're at it, check the focus of both lights, test bulb connections, and clean up the reflectors.

Most of the adjustments needed to make the average car safe, inspectors say, can often be made by the motorist himself. Periodic check-ups take little time, and they may save a life.

**CLEAN BILL OF HEALTH.** If a car passes the test, a decalcomania sticker is attached to the windshield, telling date of the examination and when another is due



**BRAKES.** When an automobile is driven onto the plates of this machine, and brakes are applied, the braking effort of each wheel is registered



# Parachute-Jumping Nurses

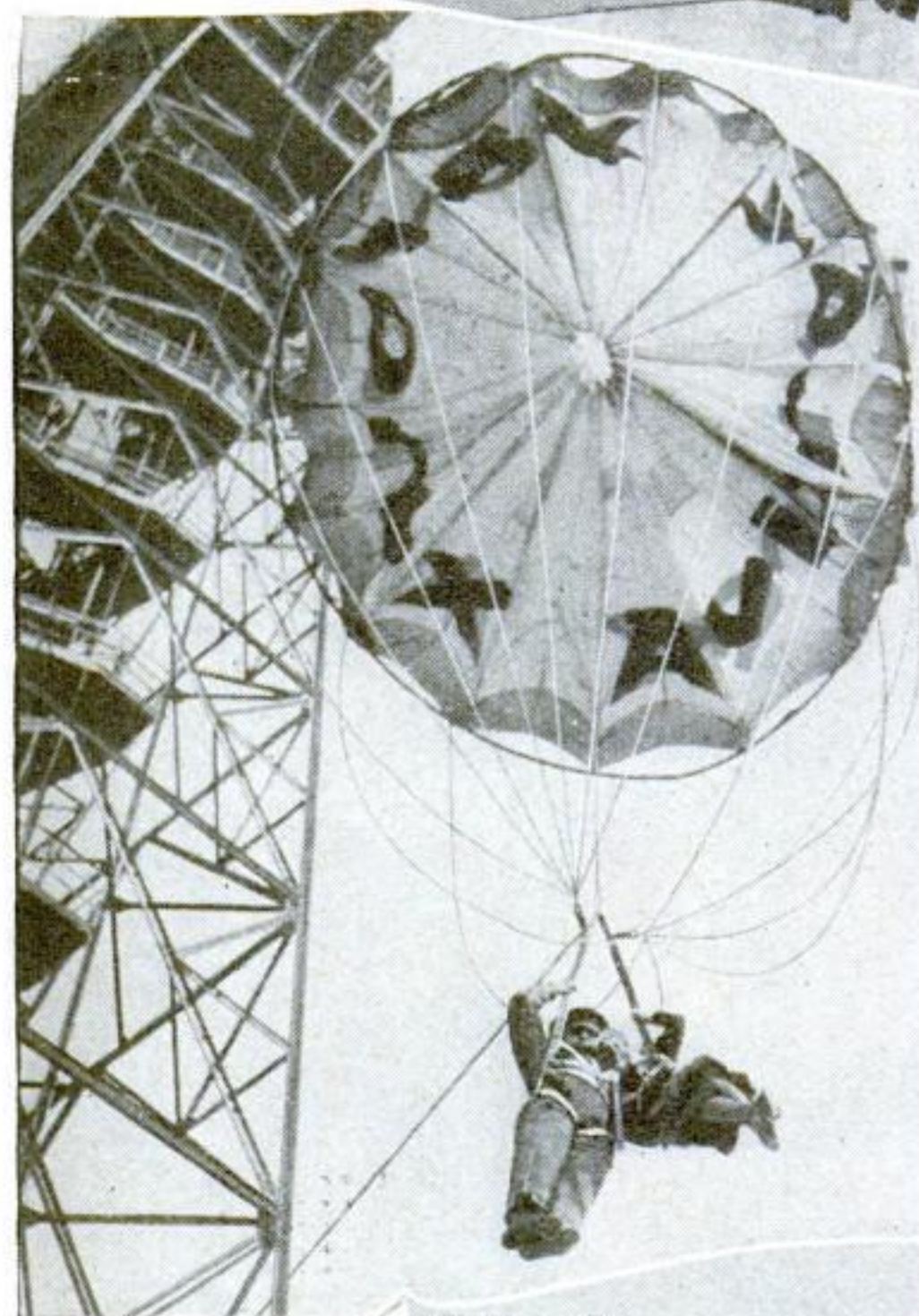
BRING FIRST AID FROM THE SKY



**M**ORE than 200 Frenchwomen have enlisted in a newly formed parachute corps, to bring help from the air to injured mountain climbers and victims of air crashes and floods. Besides these peacetime activities, they will be ready to perform invaluable services as nurses in case of war. Dropped from speeding planes, they will care for the wounded among isolated troops.

Recruits are given a comprehensive training including a thorough grounding in first aid and emergency medical treatment. Meanwhile, they accustom themselves to the novel sensation of parachuting to their destination—first with captive parachutes arranged to descend on controlled cables from high towers, and finally with real 'chutes from airplanes.

Lightweight stretchers and operating tables, and speedily erected tents, have been designed especially for the use of members of the parachute corps and are carried with them when they leap to earth on their errands of mercy.



A recruit for the French parachute nursing corps beginning her training by leaping from a practice tower. The parachute is guided by steel cables

At the right, an expert is showing a group of volunteers how a parachute is folded and what makes it work. This is an important part of their preparation



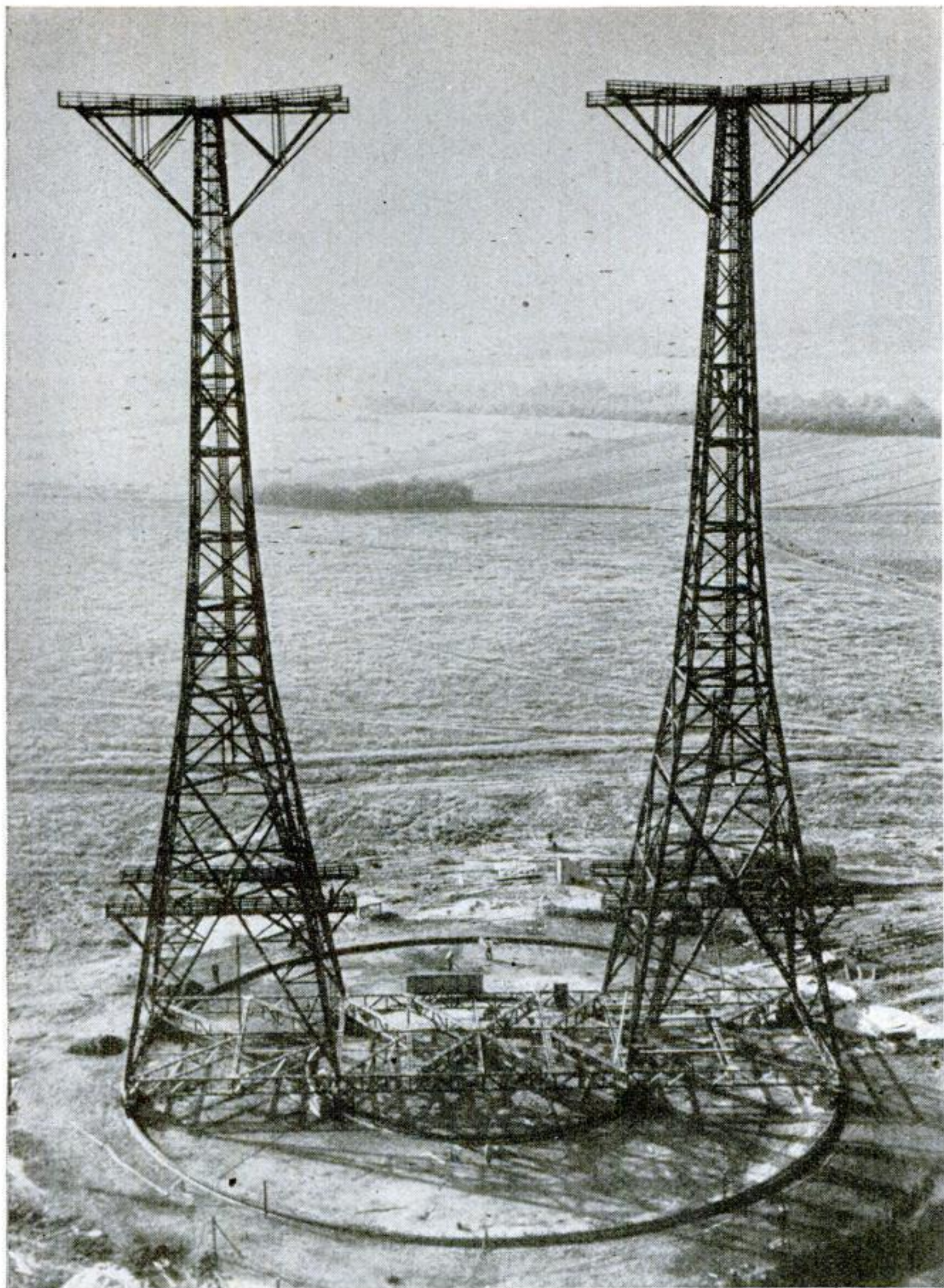
This nurse was a little timid the first time, so an instructor made the jump with her

A field hospital, complete with a stretcher, tent, and medical supplies, all dropped from airplanes



Her parachute strapped on her back, this member of the corps is ready to rush aid to injured persons anywhere





Towers of a new Dutch short-wave radio station. They revolve on a circular track

## Big Rotating Towers Aim Radio Signals

GIANT radio towers that can be turned on their mountings to aim radio signals in any desired direction have recently been completed for short-wave station PCY in Holland. Mounted on wheels that roll along circular tracks, the 200-foot towers support the station's special directional-antenna wires and allow them to be adjusted to any point on the compass to produce a directional effect similar to that obtained with the common type of loop antenna employed by aircraft.

## Rake Resembles Lawn Mower

OPERATED like a lawn mower, an ingenious English device speeds up the work of raking a lawn. The mechanical rake has adjustable spring-steel fingers spaced along a metal framework that is rolled over the grass.

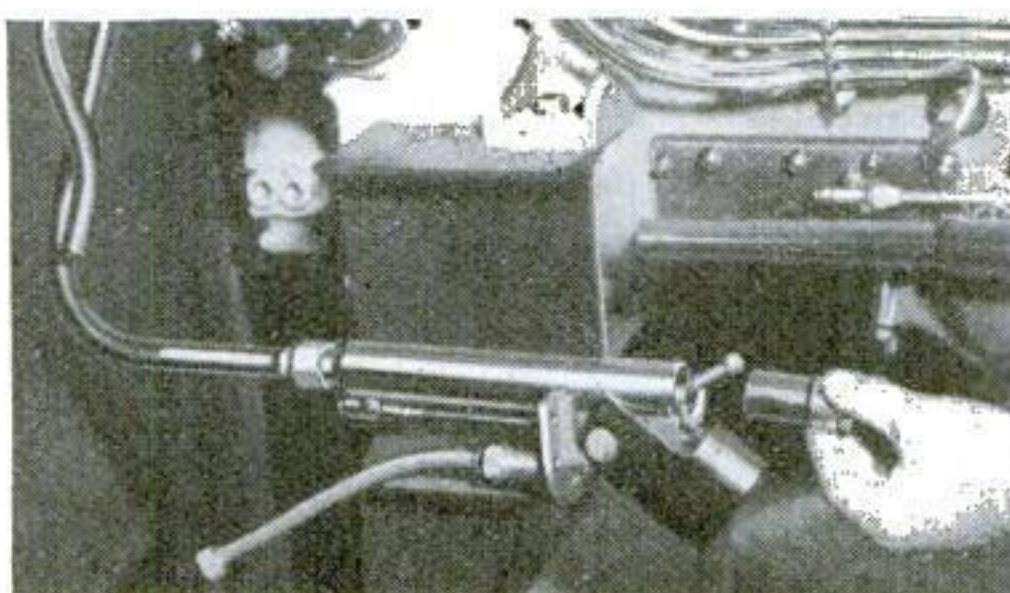
This mechanical rake is pushed across the lawn on its rubber-tired wheels



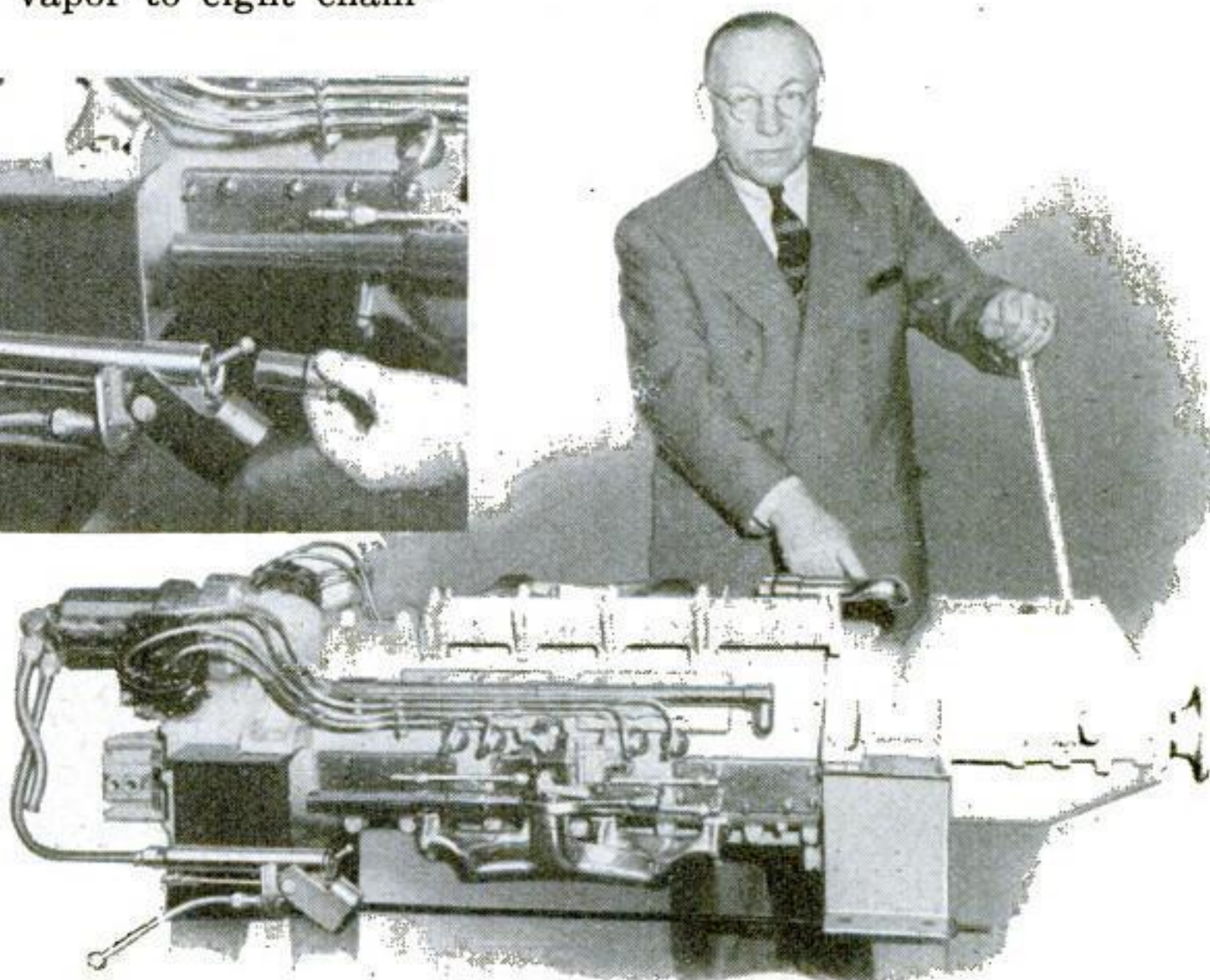
## Cartridge Starts Gasoline-Driven Turbine

AN EXPLOSION from a powder cartridge starts a new gasoline-driven turbine engine now manufactured as an efficient power plant for boats. Developing from 100 to 125 horsepower, the marine engine employs two carburetors to feed gasoline vapor to eight cham-

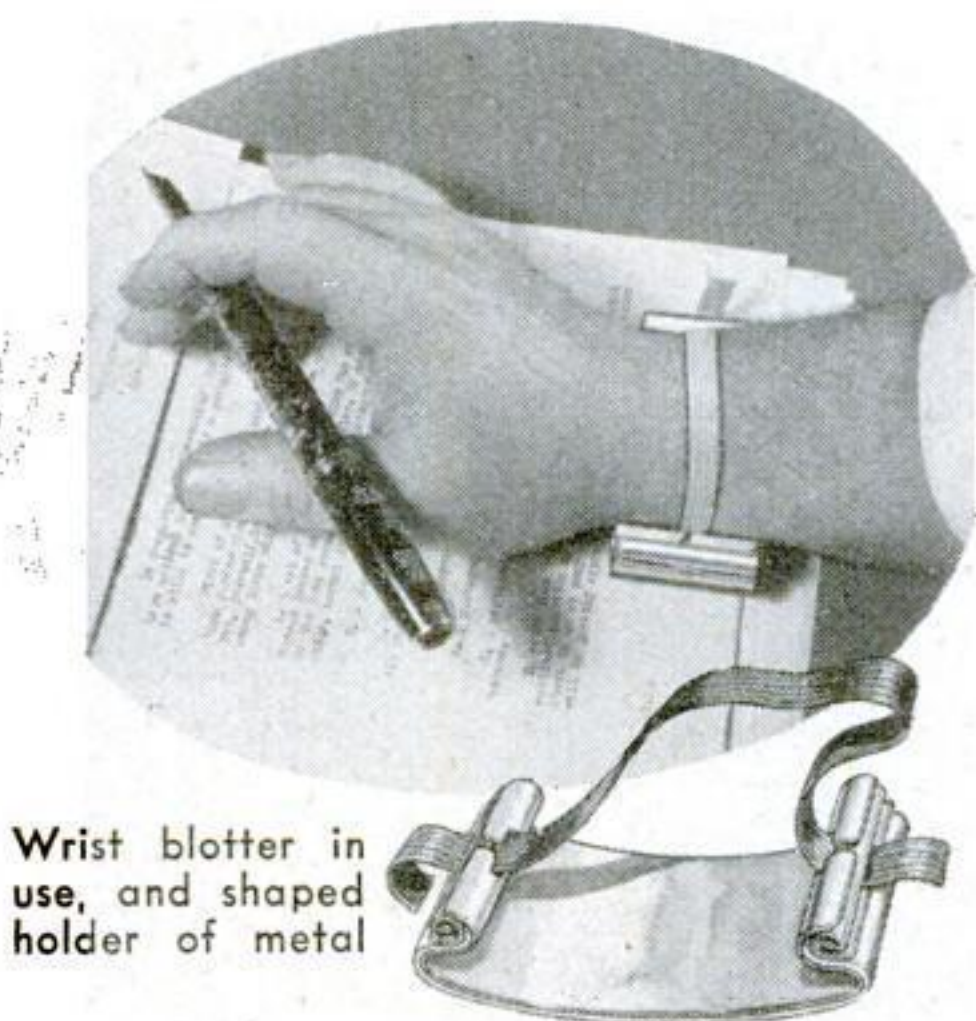
bers, where it is ignited by spark plugs that fire twice for each revolution of the turbine blades. The new engine, weighing about 400 pounds, can also be adapted for use in aircraft. It has an internal water-cooling system.



Powder cartridge being inserted in its chamber to start the engine



Gasoline-driven marine turbine engine with its inventor, H. E. Dodge



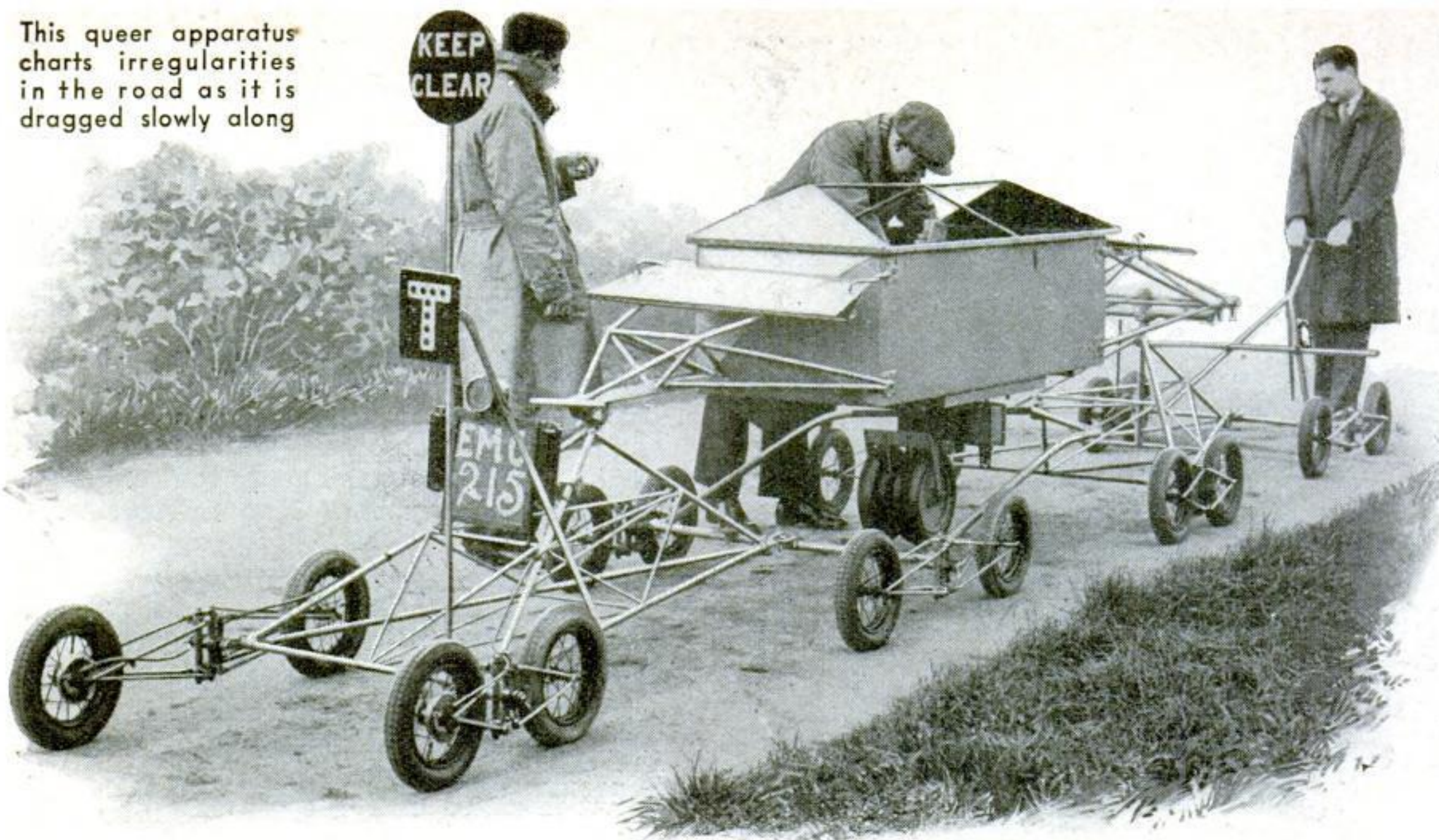
Wrist blotter in use, and shaped holder of metal

## Blotter Worn on Wrist Aids Letter Writers

SLIPPED over the hand and worn like a bracelet, a blotter that is strapped to the wrist forms a handy accessory for persons who write with pen and ink. Curved to fit, the blotter is backed by a holder strip of lightweight metal. The elastic strap is adjustable so that it can be tightened or loosened to fit wrists of any size. The blotter is specially useful to executives who sign correspondence.

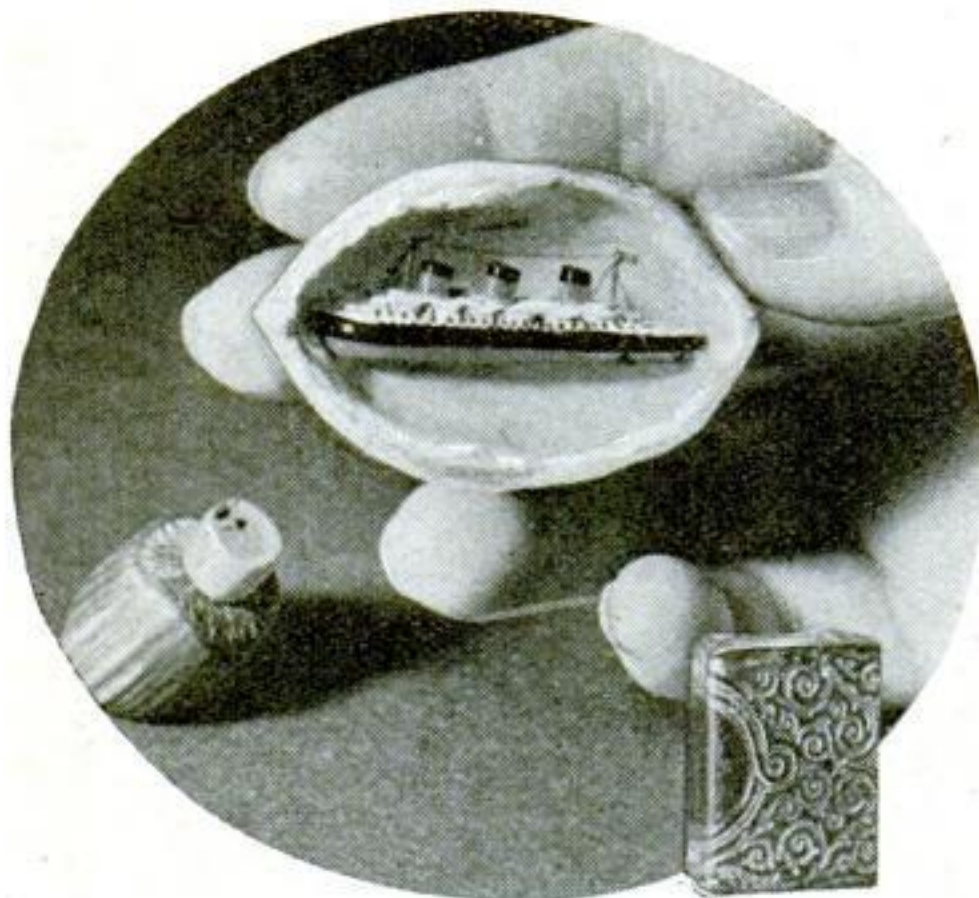


This queer apparatus charts irregularities in the road as it is dragged slowly along



## Road Tester Maps Bumps in Highways

MOUNTED on nineteen rubber-tired wheels connected to a metal instrument box, the odd machine shown in the photograph at the left is used by highway authorities to check and chart irregularities in the surfaces of roads. In the instrument box, graph paper on a revolving drum is marked by an inked stylus to record bumps and depressions as the apparatus is drawn along a road.



## A Liner in a Nutshell

FITTING into a walnut shell, a diminutive reproduction of the French liner *Normandie* was one of the features of an exhibition of miniatures held in Boston, Mass. Other oddities shown in the photograph above are a tiny book and a hazelnut containing 3,000 gold spoons.

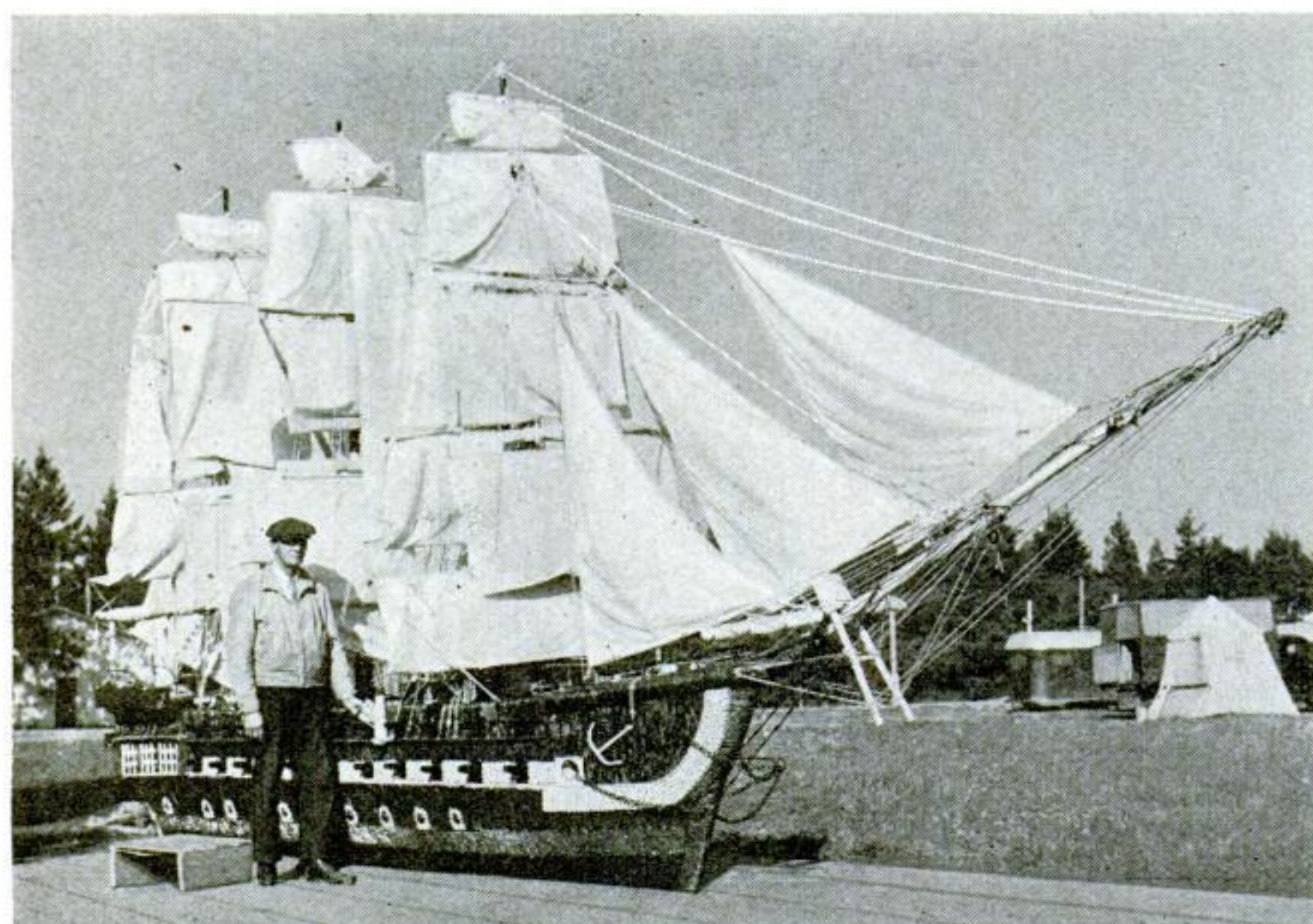
## Midget Outboard Has Motor Under Water

DESIGNED for trolling use by anglers, a midget outboard motor just introduced has its cylinder and all moving parts under water, so that no special cooling system is needed. The lightweight engine employs a 1 1/16-inch

spark plug of the type commonly employed in model-airplane motors. Together with the carburetor, the diminutive plug is incased in a water-tight housing just above the propeller, as shown in the photograph below.



Diminutive spark plug being inserted in its water-tight housing on the shaft of the tiny outboard



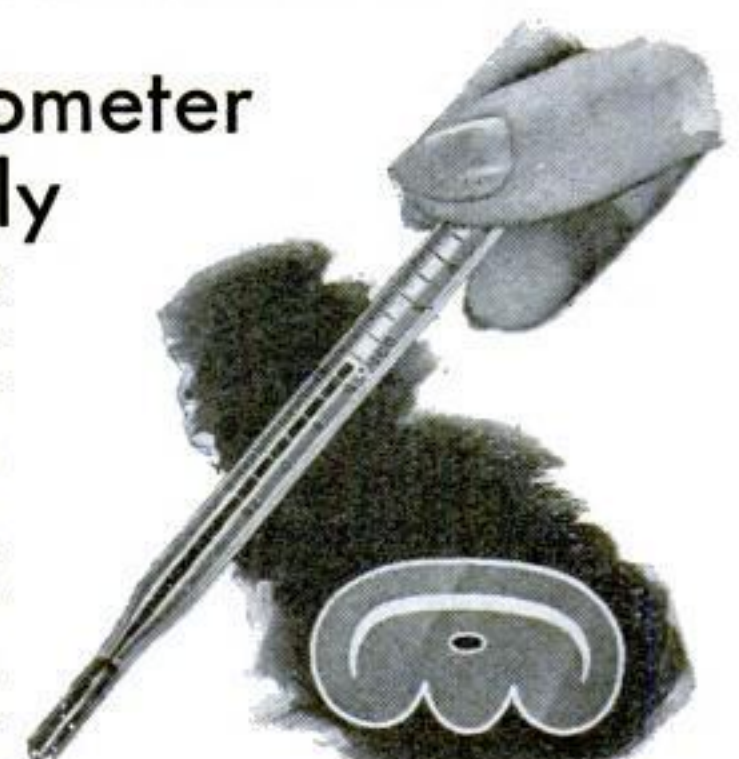
Loring A. Wood, of Portland, Ore., beside his model of the famous "Old Ironsides"

## Big Ship Model Comes Apart

BUILT by Loring A. Wood, of Portland, Ore., a twenty-five-foot, fully rigged model of the U.S.S. *Constitution* stands fourteen feet high and carries forty square yards of canvas. Intended for exhibition, the model can be dismantled.

## Oval Thermometer Is Read Easily

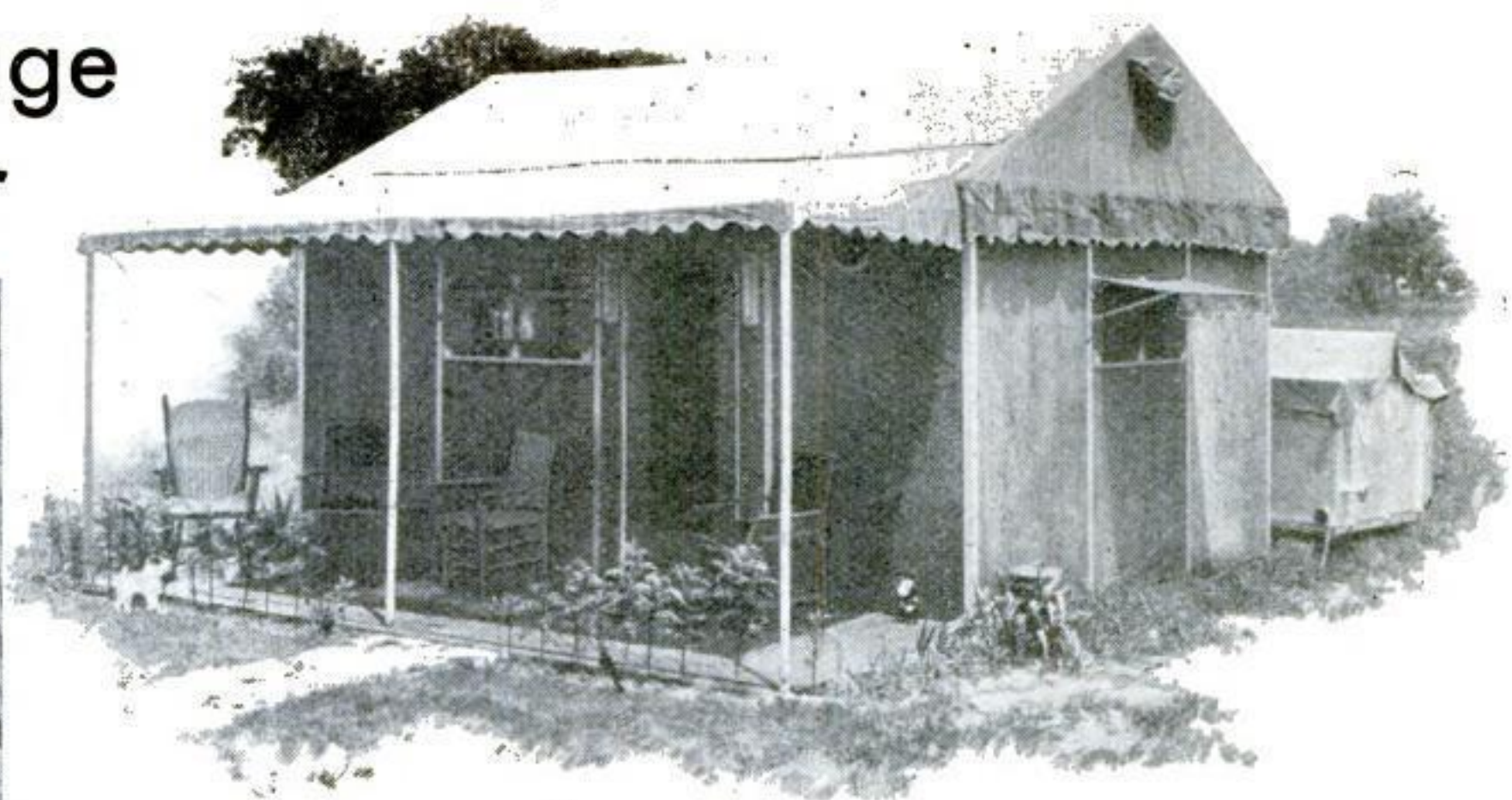
NOVEL design of the glass in a new clinical thermometer makes it easy to read. Being oval in shape, the thermometer fits comfortably under the tongue when in use, while the triple-lens construction serves to magnify the column of mercury.



Sketch shows lens construction that magnifies mercury column

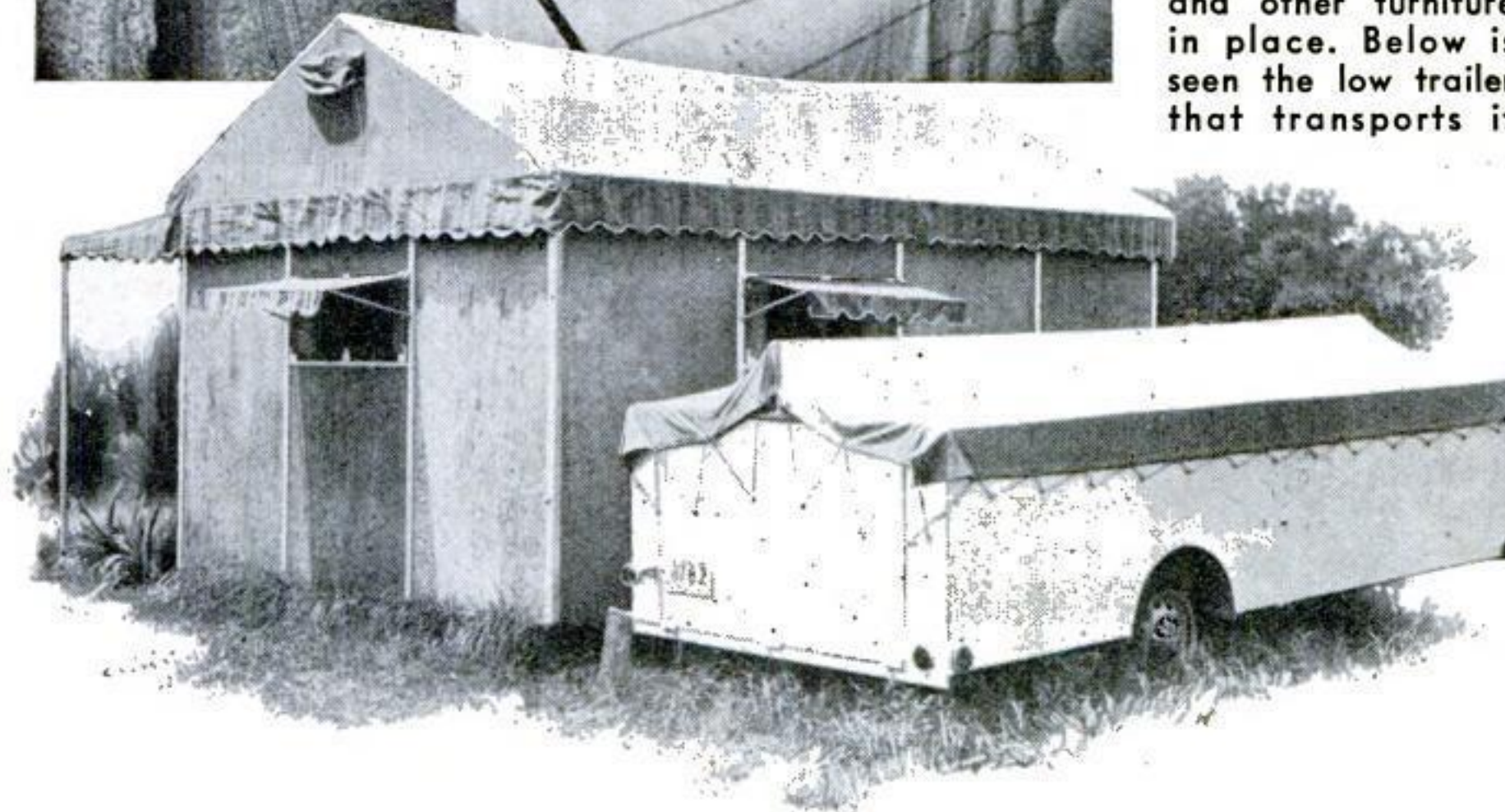


# Portable Folding Cottage Is Hauled on Trailer



The cottage set up for use. A roof of heavy canvas is stretched over rigid wall units of plywood held together by aluminum-alloy structural members

Interior of the portable home, with beds and other furniture in place. Below is seen the low trailer that transports it



Another inside view, showing the stove, dining table, and glass door. Note the cozy, homelike appointments

**C**OMBINING many of the features of a trailer, tent, and small dwelling, a portable cottage designed for campers and vacationists is constructed in units that can be assembled or dismantled in a few hours. Hauled on a sixteen-foot

trailer, the mobile home has a heavy canvas roof stretched over rigid wall units made of treated plywood that are held together with aluminum-alloy structural members. The trailer, built low enough to permit rear vision from the

car, can accommodate not only the knocked-down twelve by sixteen-foot cottage but also a fourteen-foot outboard-motor boat and complete furnishings for the rolling home. Details of the mobile cottage are pictured above.

## Glass Boots Apply Suction and Pressure

**GLASS BOOTS** of a new type stimulate the circulation of blood by subjecting each leg alternately to air pressure and to partial vacuum. Used in the treatment of hardening of the arteries and

other circulatory ailments, the device has a compact electrically operated pump that automatically raises and lowers the pressure within air-tight cases fitted over the patient's legs. This alternating feature is said to provide a compensating action on the flow of blood and eliminate the possibility of overloading the heart.



A patient receiving treatment with a glass boot on each leg. Alternate suction and pressure stimulate circulation to relieve hardening of the arteries



## Chute for Coal Delivery Ends Noise and Dust

**NOISELESS** and dustless delivery of coal from trucks into home bins is made possible by a device invented by R. E. Wall, of Winston-Salem, N. C. Operated by the truck motor, one conveyor belt feeds coal to a chute, where a second belt carries it down to the bin. Hot oil vapor automatically sprayed on the coal lays the dust.



# Surfboard Sailing Is Novel Sport

SURFBOARD sailing, a new sport devised by Tom Blake, American surfboard expert, offers new thrills for water-sports enthusiasts. As seen in the photographs at the right, a triangular, lateen-type sail stretched between two spars is pivoted to a vertical mast. The latter is set into a wooden support that is fastened to the center of the surfboard. Lying prone along the stern, the rider steers the odd craft by changing the position of the sail.

## Dogs Make Bow on Radio

IN A radio broadcast over a nation-wide hook-up, two dogs owned and trained by Mrs. Hilda Lenhart of Baltimore, Md., startled listeners by "talking." Under the guidance of their owner, the animals emitted controlled grunts and barks that simulated to a remarkable degree the sounds of simple words.



Mrs. Hilda Lenhart, of Baltimore, Md., and her talking dogs



Surfboard equipped with a sail. In actual use, the rider lies prone along the stern and steers the craft by means of the sail, as seen in the inset

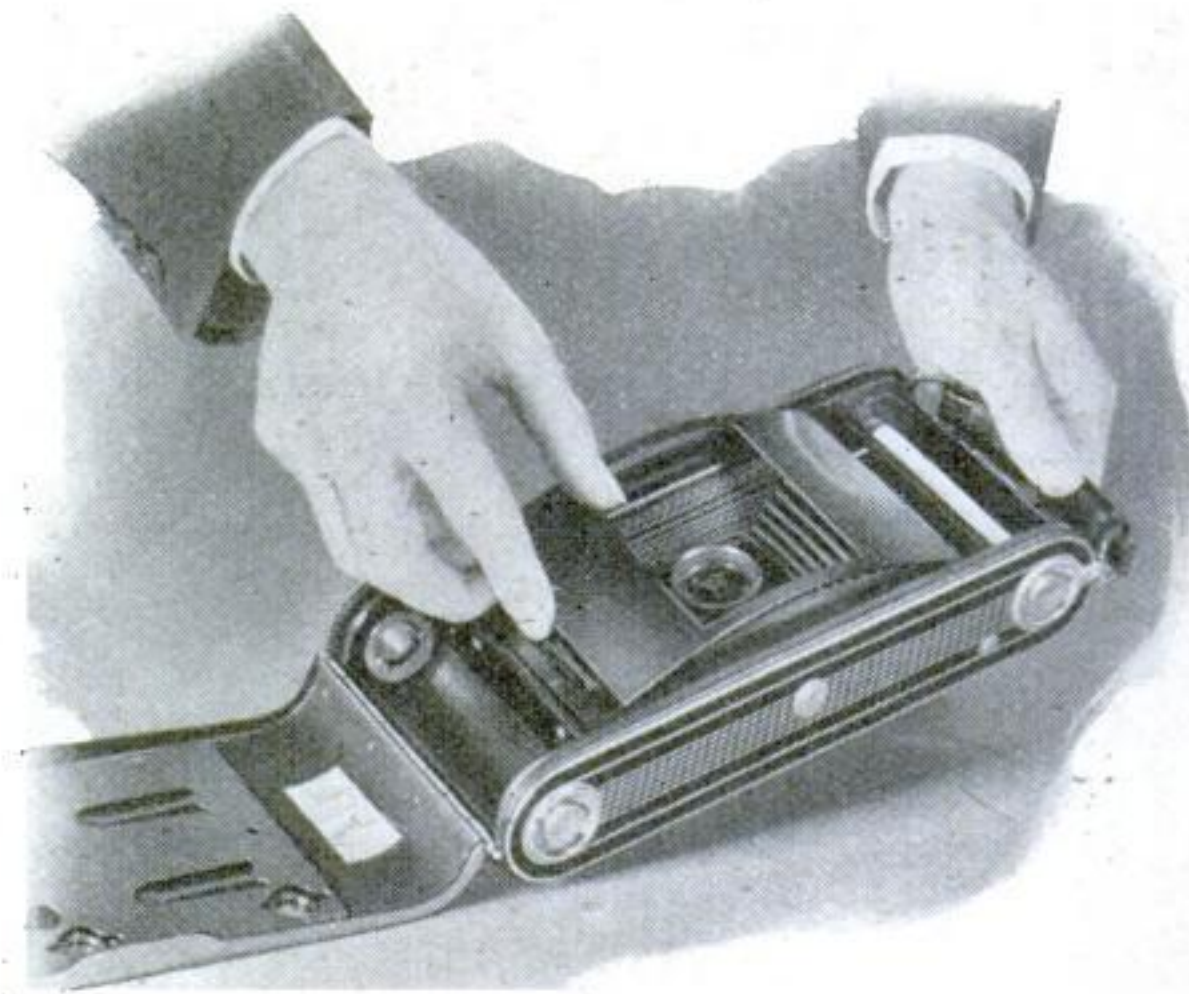
## Lawn Conditioner Keeps Soil Porous

LAWN soil is kept porous with a novel machine developed in England. Mounted on a rubber roller, a square frame has rows of steel spikes on each side. As the machine

is pushed over the grass, the frame rotates, thus driving in the spikes to puncture the ground for circulation of air and water. The device is shown in use in the picture below.



Spikes on this odd lawn machine make holes in the soil to admit moisture and air. At left, the frame has been raised to put the weight on a roller



## Special Back for Camera Gives More Exposures

OWNERS of cameras of a popular size and make can take eleven pictures on a six-exposure roll of film, by installing a novel camera back just marketed. A metal mask, slipped inside the camera, frames a picture area smaller than normal. The film is wound until a number appears in the first of two windows in the new back. When the picture is snapped, the film is wound until the same number appears in the second window, when another shot may be taken.



# POPULAR SCIENCE

## Question Bee

Are you well posted in scientific and mechanical lore? Test yourself with this entertaining quiz. Each of the twenty-five questions below has only one correct answer. Jot down

the letter corresponding to what you believe to be the correct answer in each, and then compare your results with the list on page 130 and add up your points to determine your score



**1** To open his parachute, an aviator pulls the (a) cable release (b) drawstring (c) rip cord (d) BX cable (e) lubber's line (f) slip rings.

**2** Every motor car should be provided with (a) oil drums (b) snare drums (c) brake drums (d) signal drums.

**3** "Nitrogen fixation" means (a) an abnormal, uncontrollable craving for protein foods (b) the use of an ammonia fixing bath for photographic films and prints (c) the process of converting the nitrogen of the air into compounds for fertilizers and explosives.

**4** A commonly used unit of heat is abbreviated (a) S.O.S. (b) Q.E.D. (c) T.N.T. (d) R.I.P. (e) B.T.U. (f) R.P.M. (g) F.O.B.

**5** The most recently discovered major planet of the solar system has been named (a) Andromeda (b) Jupiter (c) Eros (d) Sagittarius (e) Pluto.

**6** You should use nothing but insulated wire for (a) the heating element of a toaster (b) a radio antenna (c) a bridge-lamp cord (d) a trolley wire.

**7** An important part of a submarine is its (a) water tower (b) conning tower (c) switch tower (d) shot tower.

**8** If you are excessively troubled with colds and sore throats, you may need to part with your (a) appendix (b) wisdom teeth (c) tonsils (d) medulla oblongata.

**9** You are likely to find oil in geological formations called (a) foot faults (b) varicose veins (c) salt domes (d) Heaviside layers.

**10** Squirrel-cage motors are run by (a) electricity (b) steam (c) gasoline (d) squirrels.

**11** A three-point landing is (a) a military maneuver for outflanking an enemy ashore (b) a good way to bring down a plane (c) an architectural feature employed in long staircases (d) a boat dock built in the form of a triangle.

**12** Sound will not travel through (a) water (b) air (c) metal (d) a vacuum.

**13** The places on a doorbell battery where you connect the wires are known as (a) magnetic poles (b) connecting rods (c) binding posts (d) jackscrews.

**14** A peccary travels on (a) endless treads (b) rails (c) four legs (d) pneumatic tires (e) wings (f) skatelike runners.

**15** Carpenters use (a) least squares (b) try-squares (c) hollow squares (d) magic squares.

**16** Dakin's solution (a) solves the age-old problem of squaring the circle (b) disinfects wounds (c) is a fine-grain developer for miniature-camera films.

**17** Hot-water systems for house heating require (a) a watermark detector (b) a Tesla coil (c) floodgates (d) an expansion tank (e) thermionic valves.

**18** A poisonous, orange-and-black lizard of the southwestern United States is called the (a) Frankenstein monster (b) green-eyed monster (c) Gila monster.

**19** A dado is (a) a large extinct bird of the island of Mauritius (b) a rectangular groove in a board (c) a farm building for storing and preserving green fodder.

**20** We usually do our figuring with (a) atomic numbers (b) Lissajous figures (c) Arabic numerals (d) an abacus.

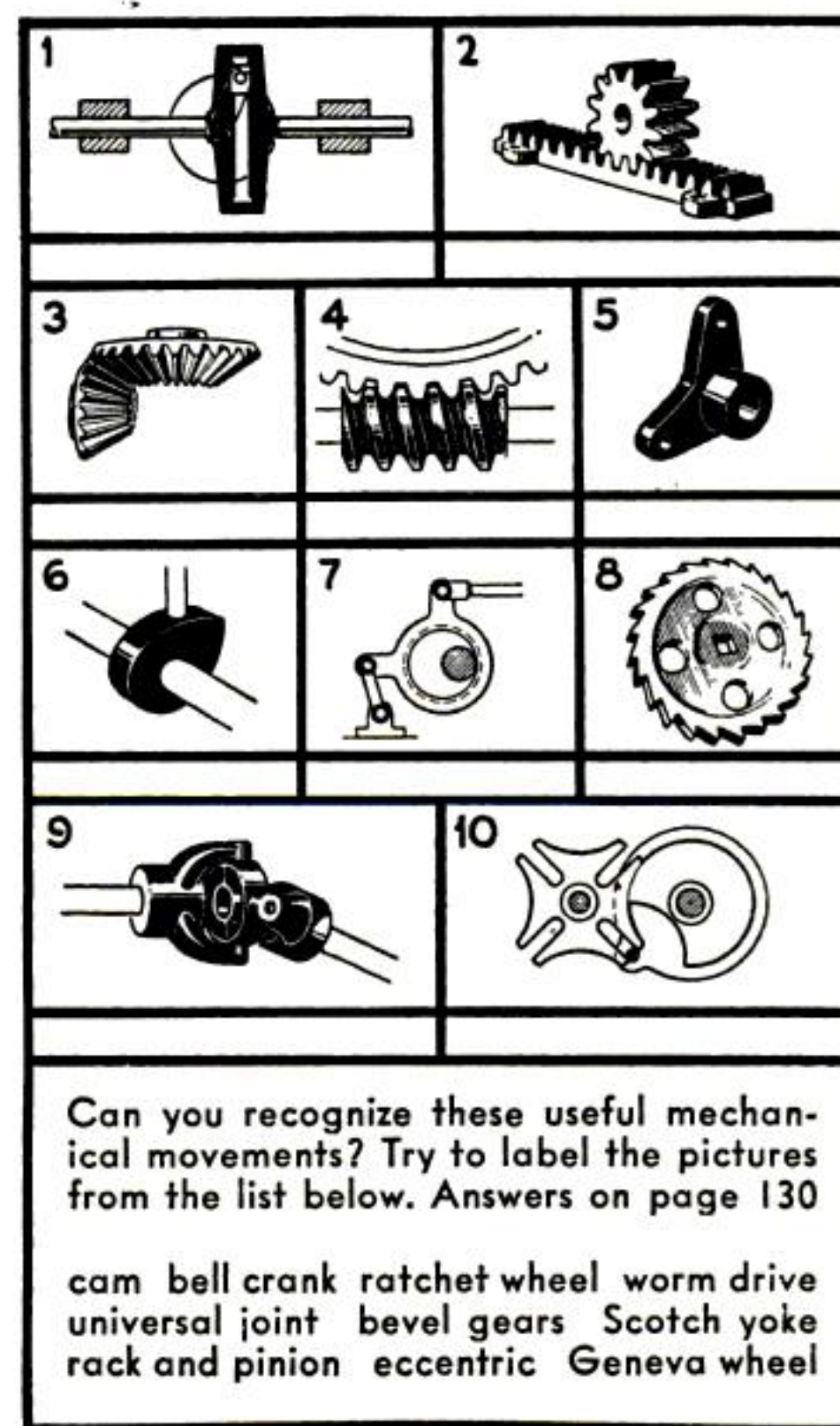
**21** To make an electric eye, you would need a (a) electrolytic cell (b) Kerr cell (c) photo-electric cell.

**22** Botulism is the name for (a) weird, mystical rites practised by natives of Haiti (b) a system to speed up factory production (c) food poisoning caused by one of the deadliest germs known to science.

**23** Leaf springs are used in (a) beds (b) automobiles (c) watches (d) springboards.

**24** "Right ascension" is a term employed by (a) architects (b) balloonists (c) mountain climbers (d) astronomers.

**25** If you have developed a new kind of flower or vegetable, you can now (a) patent it (b) join the Caterpillar Club (c) get a license to practice horticulture (d) insert your name in "Who's Who."





# Un-Natural History

By  
GUS MAGER



FOR STRIPPING MEAT OFF BONES, THE **LION** HAS A COARSE RASP OF A TONGUE, SO ROUGH THAT IT WILL BREAK THE SKIN OF A MAN!



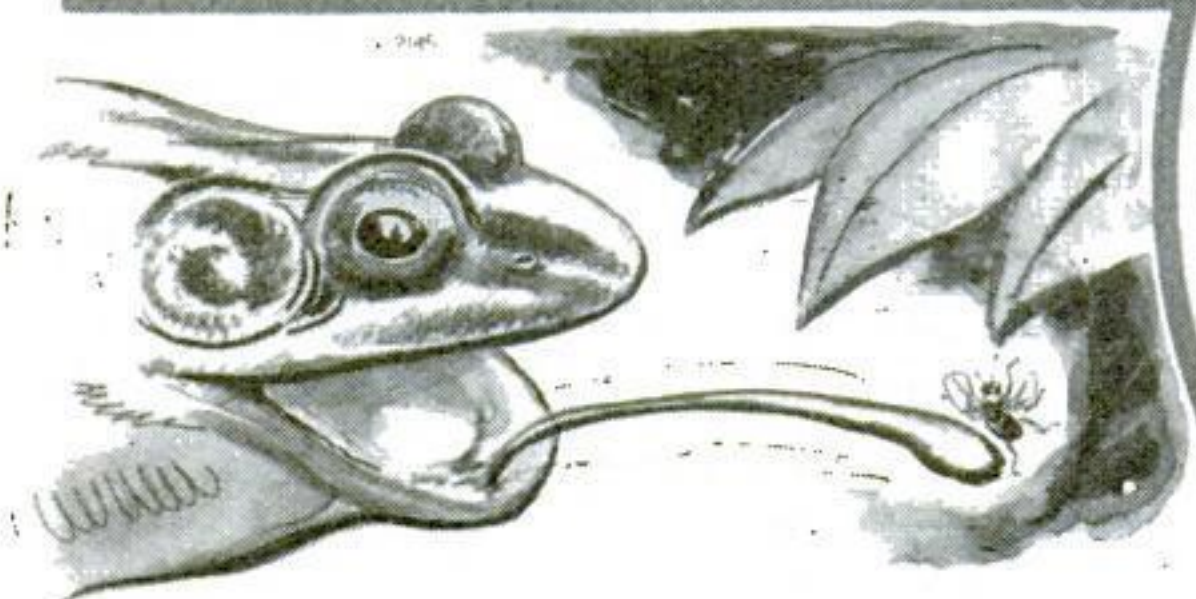
MOTHER NATURE HAS EQUIPPED HER CREATURES WITH AN ALMOST ENDLESS VARIETY OF TONGUES! THE **HUMMING BIRD'S**, FOR INSTANCE, IS DOUBLE-BARRELED --- TWO THREADLIKE TUBES PLACED SIDE BY SIDE AND USED AS SIPHONS TO SUCK NECTAR FROM FLOWERS!



ROUGH TONGUES RUN IN THE CAT FAMILY --- EVEN THE **HOUSE PUSS** HAS ONE! KITTY'S TONGUE ALSO RESEMBLES THAT OF THE LION AND TIGER IN FORMING A CUP TO SCOOP UP LIQUID IN DRINKING!

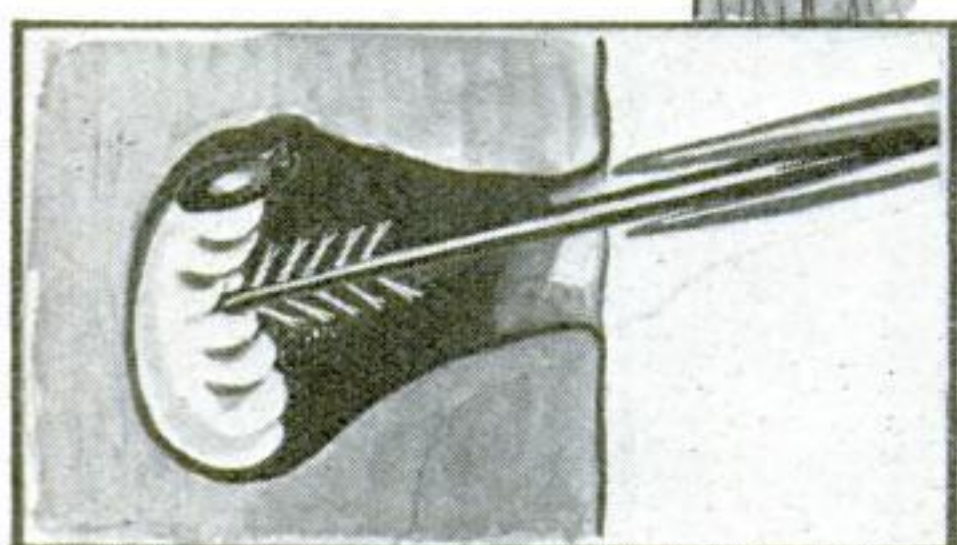


A HANDY GRASPING TOOL IS THE TONGUE OF THE **GIRAFFE**! IT CAN BE STRETCHED OUT LONG AND THIN TO CURL AROUND LOFTY TREE BRANCHES, OR MADE SHORT AND THICK FOR RETRACTING!

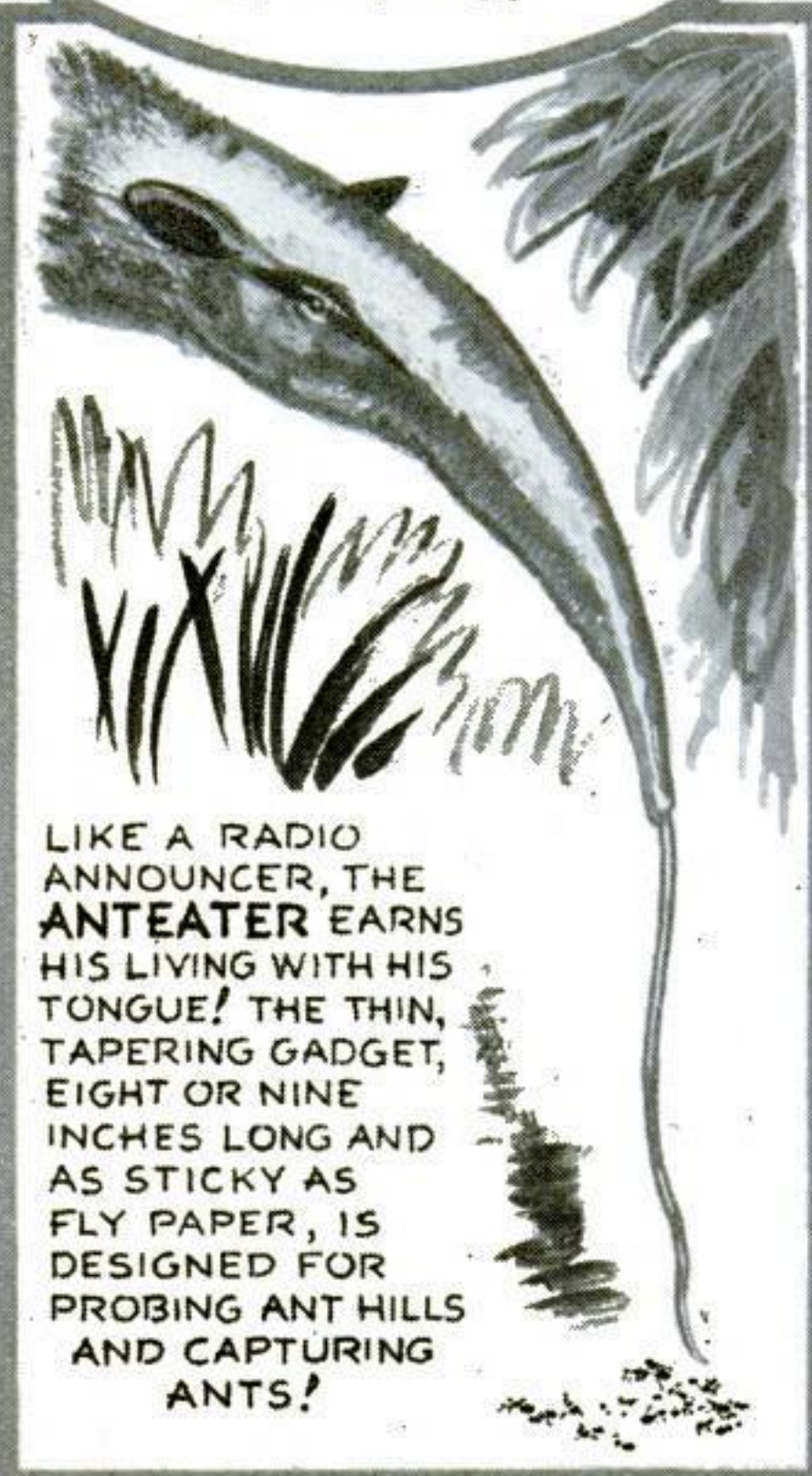


THE **FROG** HAS A TONGUE LIKE A STICKY RUBBER SLING, WHICH IS ROOTED IN THE FRONT OF THE MOUTH AND SHOOTS OUT WHEN AN INSECT COMES INTO RANGE. AT REST, THE TONGUE POINTS BACK INTO THE THROAT!

MANY **FISHES** HAVE NO TONGUES AT ALL, OR IMPERFECT ONES WITH NO MUSCLES TO STRETCH OR RETRACT THEM!



THE **WOODPECKER** HAS A SHARP TONGUE IN HIS HEAD --- NOT FOR SCOLDING, BUT TO SPEAR BORERS AND DRAW THEM OUT OF HOLES IN TREES!



LIKE A RADIO ANNOUNCER, THE **ANTEATER** EARNS HIS LIVING WITH HIS TONGUE! THE THIN, TAPERING GADGET, EIGHT OR NINE INCHES LONG AND AS STICKY AS FLY PAPER, IS DESIGNED FOR PROBING ANT HILLS AND CAPTURING ANTS!

**SNAKES** ARE BELIEVED TO HEAR THROUGH THEIR FORKED TONGUES, WHICH COME OUT OF THEIR SHEATHS AND SERVE AS FEELERS. THEY ARE KNOWN TO BE VERY SENSITIVE TO SOUND VIBRATIONS!

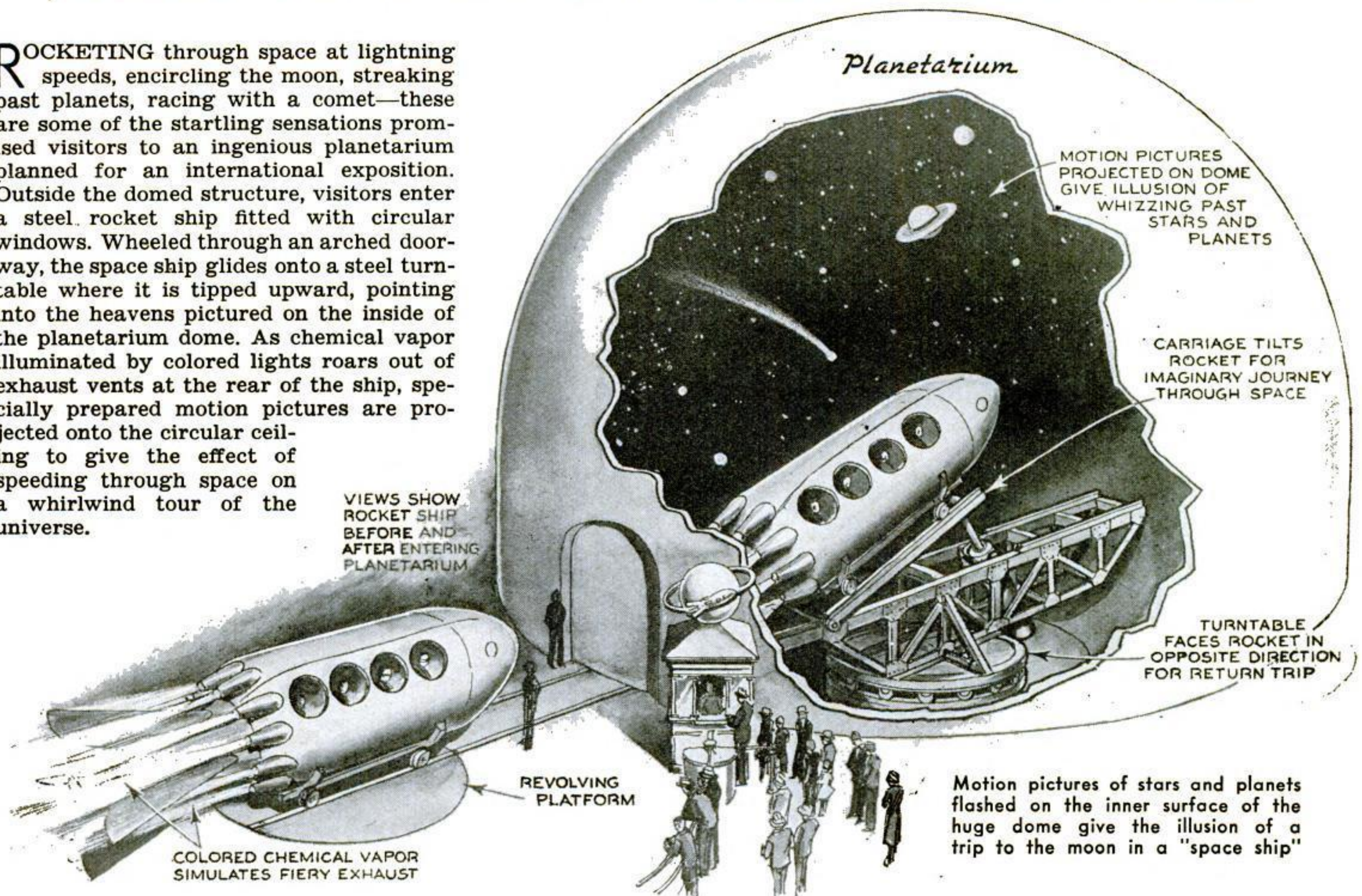


**PARROTS** ARE THICK-TONGUED! WHEN HUMANS ARE THAT WAY, THEY CAN'T TALK WELL, BUT IT DOESN'T BOTHER POLLY! THE TONGUE IS VERY NIMBLE --- HANDY FOR EATING AND IN MANY OTHER WAYS!

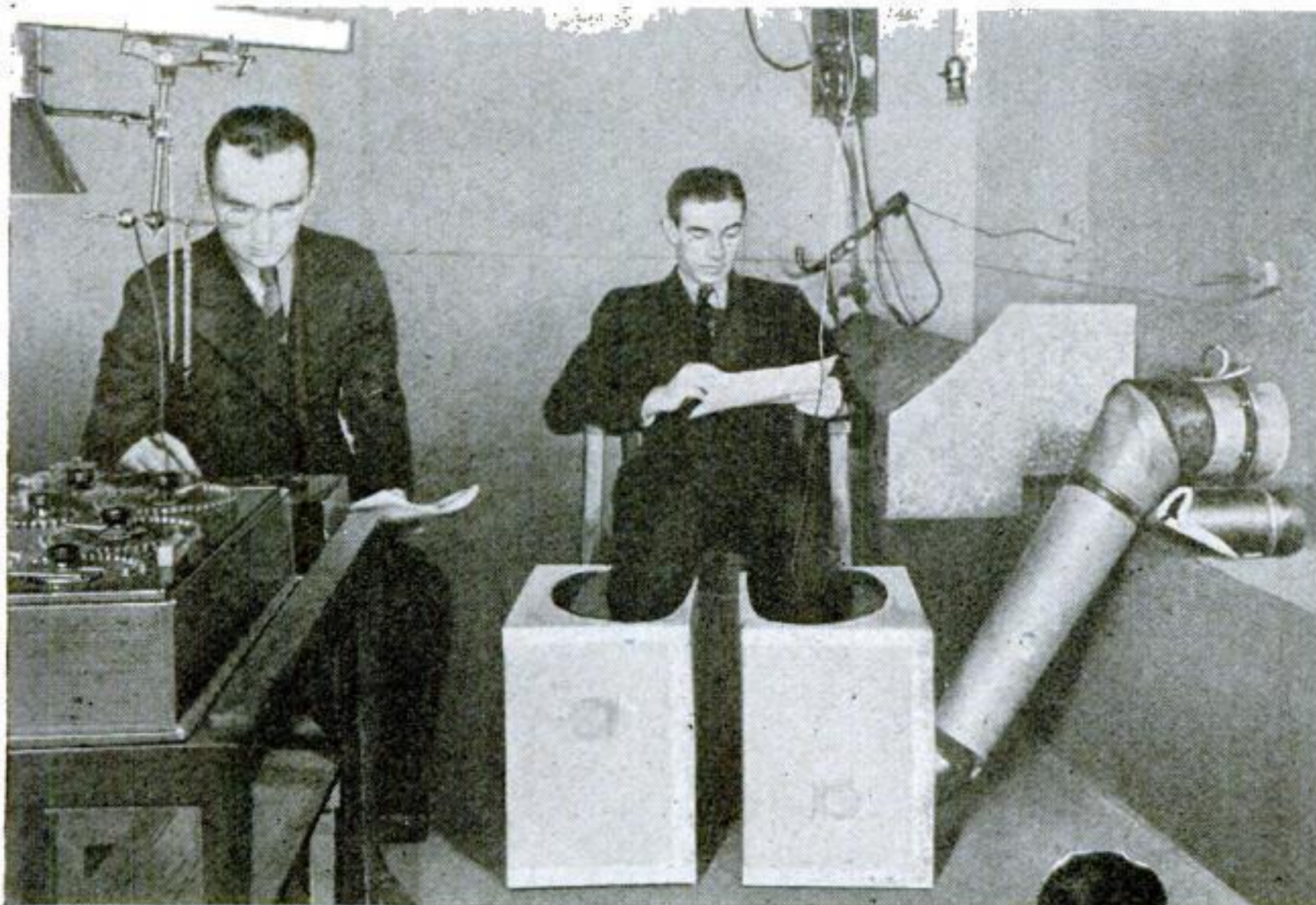


# Rocket Ride Is New Planetarium Exhibit

**R**OCKETING through space at lightning speeds, encircling the moon, streaking past planets, racing with a comet—these are some of the startling sensations promised visitors to an ingenious planetarium planned for an international exposition. Outside the domed structure, visitors enter a steel rocket ship fitted with circular windows. Wheeled through an arched doorway, the space ship glides onto a steel turntable where it is tipped upward, pointing into the heavens pictured on the inside of the planetarium dome. As chemical vapor illuminated by colored lights roars out of exhaust vents at the rear of the ship, specially prepared motion pictures are projected onto the circular ceiling to give the effect of speeding through space on a whirlwind tour of the universe.



## Laboratory Tests Check Air-Conditioning Methods



His feet in air-conditioned boxes, this man is recording his reactions to drafts on his ankles

**H**OW does the body react to changes in the temperature, humidity, and movement of the air? To determine the physiological reaction of the body to its surrounding atmosphere, scientists in Pittsburgh, Pa., and Chicago, Ill., are conducting a series of novel air-conditioning tests on human subjects. At the University of Illinois school of medicine, "exploring buttons" attached to six different parts of a subject's body

are wired to electric recording instruments that measure the sensitivity of the skin to varying air temperatures and humidities. In Pittsburgh, a laboratory subject sits with his feet in odd "ankle boxes" into which air of known temperature and humidity is blown through a duct. As electrical apparatus records skin temperature and other factors, the subject himself writes down his reactions to the draft on his ankles by filling in a specially prepared chart. Through these tests, scientists hope to set up standards for the control of air-conditioning apparatus used in homes, offices, factories, and public buildings.

Testing subject's finger tips and toes for reaction to moist air





# Handy Aids for



**TABLE BAKER.** Biscuit, muffins, and other hot breads can be baked right on the table with this novel electric unit

**DUMB-BELL SHAKER.** Salt and pepper occupy opposite ends of the shaker below, made of transparent material



**FLOATING THERMOMETER.** Dropped into deep fat or any other liquid on the stove, this floating metal sphere indicates the temperature by the reading that appears on the uppermost side. It is available in several temperature ranges



**CHAIR BECOMES A BED.** A comfortable chair by day, the piece of furniture at the right opens to form a bed for an overnight guest, as seen below



**STICKERS HOLD HOOKS**

Pressed against the wall, stickers provide hooks for hanging kitchen tools

**COFFEE MILL**

The electric mill below grinds coffee to any fineness desired





# the Homemaker

**SEVEN-IN-ONE UTENSIL** includes a roaster, casserole, steam cooker, saucepan, colander, vegetable steamer, and double boiler

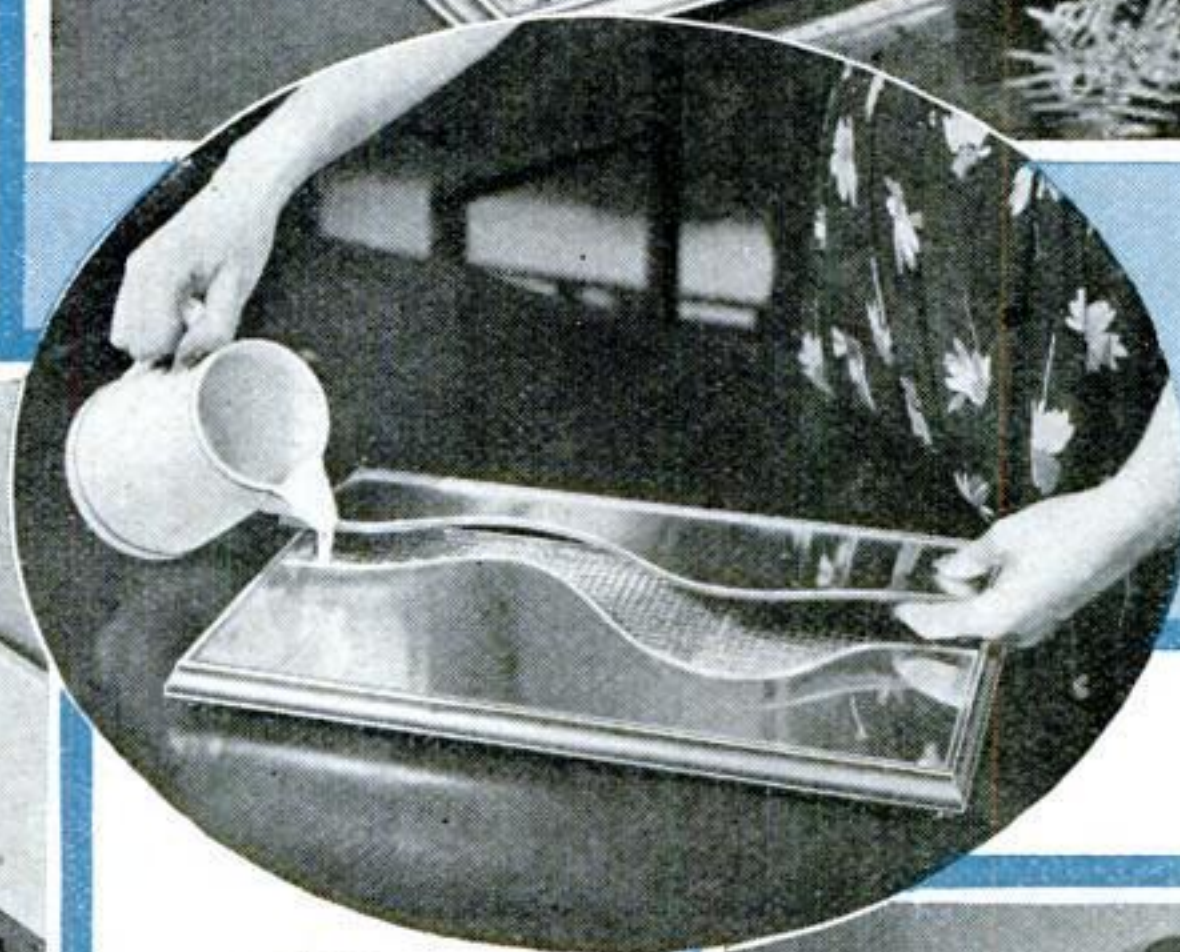


**DIVIDED STOVE TOP.** A central service table between the pairs of burners on a new gas range accommodates plates and utensils as pictured below



## FLOWER HOLDER

Blooms are kept fresh in this mirror center-piece, their stems extending through a slot into a tray of water



**SINK STRAINER.** Installed in any sink drain, a new basket-type strainer can be removed for cleaning, without soiling the fingers. It also serves as a sink stopper



**NEST OF PITCHERS.** Spouts and handles of these pitchers are so designed that the five sizes fit inside one another compactly

**JUICE SERVERS.** For serving orange or tomato juice, crystal containers shaped like fruit are filled by means of a funnel. Juice is sipped through glass stems



**CEDAR PAPER.** Designed for lining closets and drawers, a specially treated wall paper looks and smells like cedar wood and is said to be very effective as a moth repellant



# Gus Judges A Contest

By  
**MARTIN BUNN**

**A**S JOE CLARK walked into the small office that adjoined the Model Garage repair shop, early one Monday morning, he spied Gus Wilson, his partner, working at the desk. Almost hidden by piles of papers and letters, the gray-haired mechanic was busily adding up a long column of figures.

"Now let's see," Gus was muttering to himself. "Twelve and eighteen make thirty, plus six is thirty-six, plus fourteen is fifty."

"What in blazes are you doing, figuring out your income tax?" interrupted Joe.

"Might as well be," replied Gus looking up from his work. "I'm trying to figure out what part of an automobile causes the most trouble."

"What brought that up?" asked Joe, scratching his head.

Gus jerked his thumb in the direction of the piles of papers that cluttered the desk. "Answers to that contest Martin Bunn ran in POPULAR SCIENCE MONTHLY back in January. Folks from all over the world have written in telling me about their mysterious car troubles and how they fixed them. I've been reading them over and trying to figure out what

variety of trouble pops up most often."

"Running out of gas, probably," put in Joe.

"Nope. Guess again. It's the distributor, with the ignition wiring running a second. Then comes the carburetor, with dirt in the gas tank and battery trouble trailing close behind."

"What causes the least trouble?" asked Joe.

"Wasps," replied Gus with a grin.

"Wasps?" repeated Joe. "How the devil can wasps cause car troubles?"

Gus dug down to the bottom of one of the large piles of letters. "This letter comes from a fellow way out in the middle west," he said, settling back in his chair as Joe perched himself on the

edge of the desk. "He'd always had a yen to do his own repair jobs and one summer a few years back he figured he'd give the motor in his bus a thorough going-over."

"It took him a couple of weeks to do the job, and when he did finish, the blamed car ran worse than it did before. Had funny symptoms. Percolated fine at idling speeds, but nothing he could do would coax it over twenty miles an hour."

"Thinking he'd probably pulled a boner somewhere, he took the car to a garage. The mechanic there couldn't fix it, so he took it to another, and finally to a third. They tested the carburetor, the timing, the ignition—everything checked, but no one could wheedle any speed out of the blamed bus."

"What was *(Continued on page 128)*

"Listen to what he has to say in the last paragraph," said Gus, holding up the letter so that Joe could see it

## Mysterious Car Troubles

### PRIZE WINNERS

In the January 1938 issue of Popular Science Monthly, Martin Bunn invited readers to send in letters telling about the most mysterious car trouble they've ever had and how they solved it.

Many readers submitted unusually fine letters. In the opinion of the judges, I. O. Keski of Butte, Mont., submitted the best letter and was awarded the first prize of \$50. The six other prizes were awarded as follows:

#### SECOND PRIZE, \$25

Thomas H. Larocque, West Warwick, R. I.

#### THIRD PRIZE, \$5

A. C. Roe, Wilksburg, Pa.

#### FOURTH PRIZE, \$5

George Magee, Fullerton, Calif.

#### FIFTH PRIZE, \$5

Stuart Golding, Rockford, Ill.

#### SIXTH PRIZE, \$5

Carl A. Roush, Cherokee, Okla.

#### SEVENTH PRIZE, \$5

Grant O. Loader, Newcomerstown, Ohio

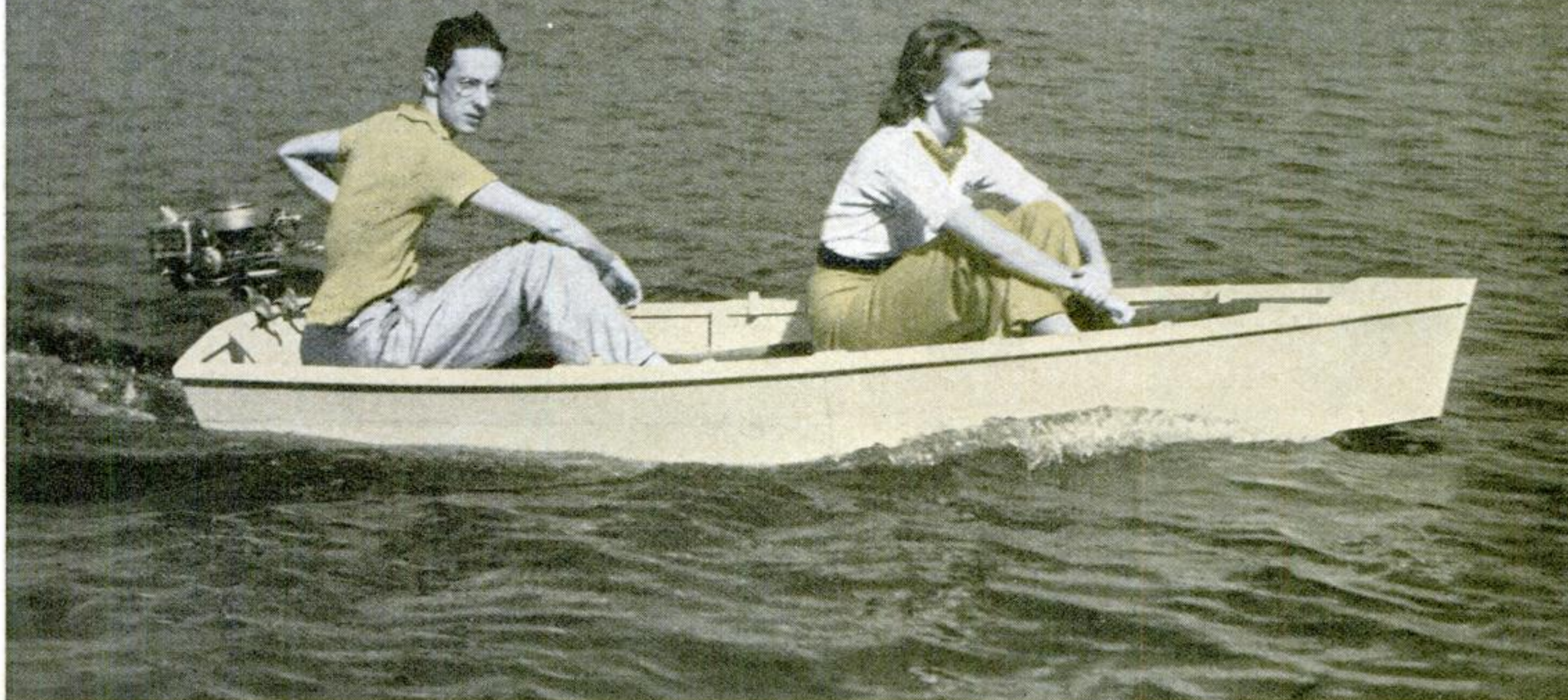
#### HONORABLE MENTION

H. W. Baer, Buffalo, N. Y.; Joseph M. Clark, Staten Island, N. Y.; E. H. Arford, Alledo, Ill.; H. E. Huey, Shelby, Mich.





# THE HOMEWORKSHOP



Designed for easy transportation, this boat is 9 ft. 8 in. long, weighs only 60 lb., and can be rowed or driven by a small outboard motor

## New Sectional Boat

BUILT IN TWO PARTS THAT NEST TOGETHER

**F**OR portability, ease of construction, and low cost, you will find it hard to equal this new sectional rowboat. It is unexcelled for all-around use, either with oars or a small outboard motor. Sixty pounds in weight, it may be carried on top or at the back of a car or even on the running board if necessary. In some automobiles it will fit inside the rear luggage compartment, and it is ideal for those who make extended trips with a house trailer.

The boat consists of two all-wood sections, each watertight so that it will float by itself. When the forward section is removed by unfastening two thumb screws, it is placed inside the rear section. The nested boat then occupies a space 64 by 41 by 15 in.

Assembled, the overall length of the boat is 9 ft. 8 in.; the beam, 3 ft. 5 in.—a size sufficient to carry three heavy persons. The draft is only about 2 in. With a light load, the boat rows very easily, and it may be used with lightweight outboards up to 4 h.p.

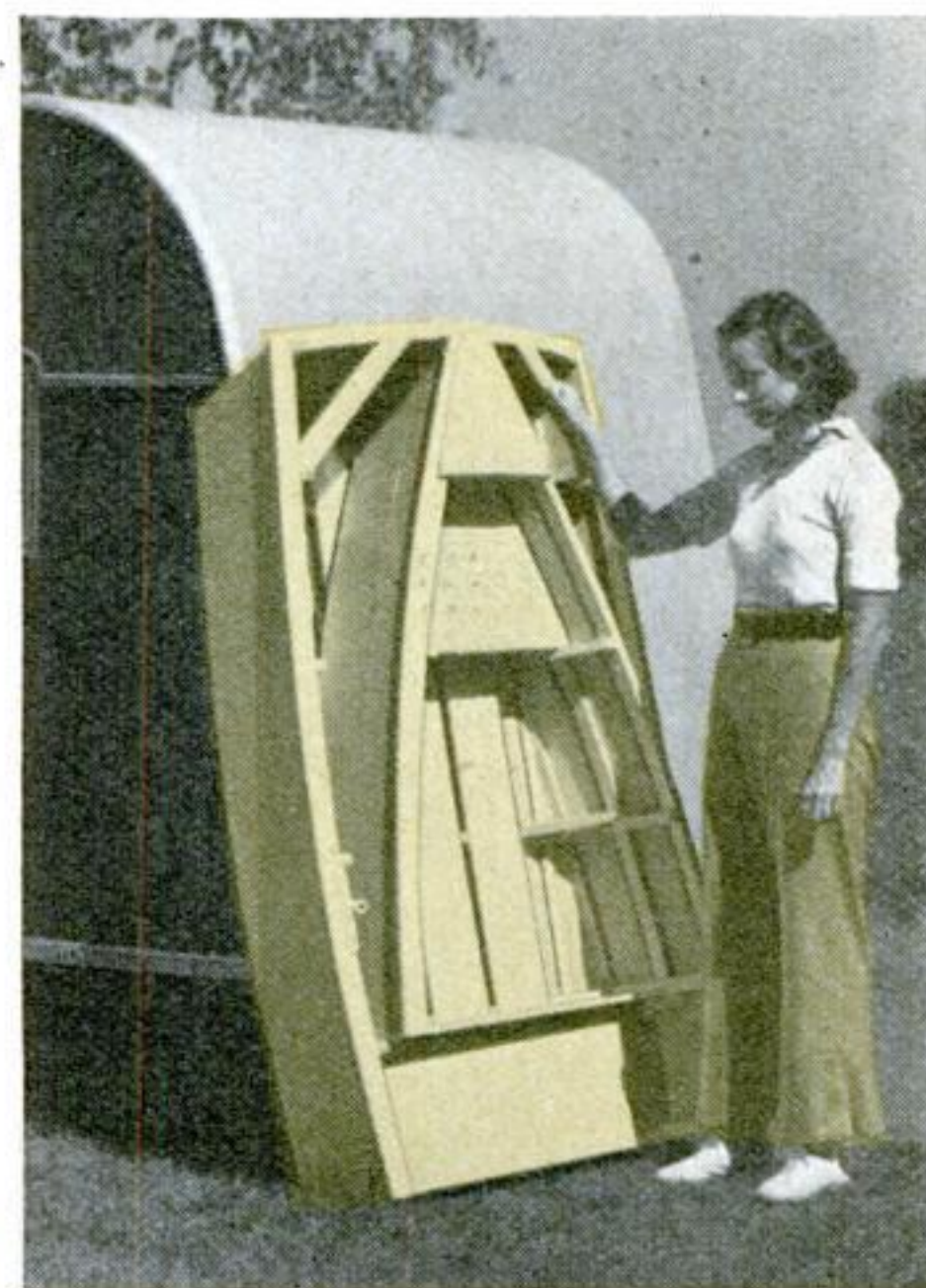
This small sectional craft has several advantages over the ordinary type of homemade folding canvas boat. There is no weight in the entire boat that does not add to the strength; also, no metal or canvas work is required to give the amateur troublesome or expensive prob-

By

WILLARD  
CRANDALL

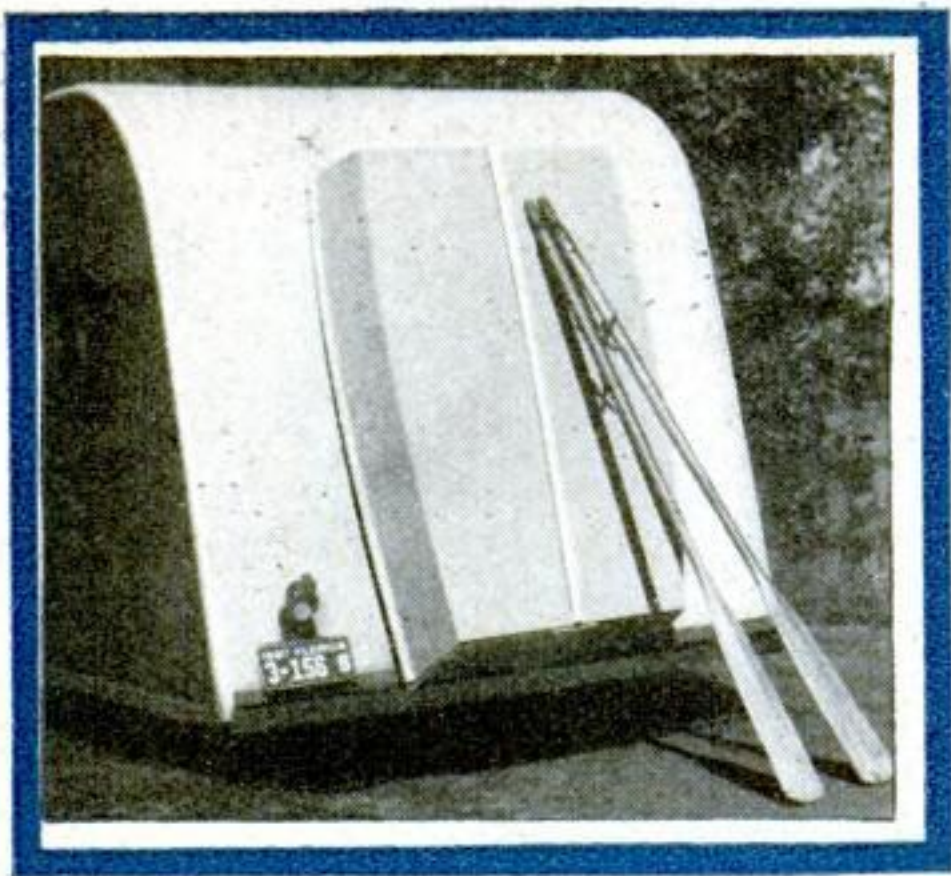
from a design by

BRUCE N.  
CRANDALL



The forward section is packed inside the other for carrying the boat on car or trailer. Even the heavier section may be handled easily by one man



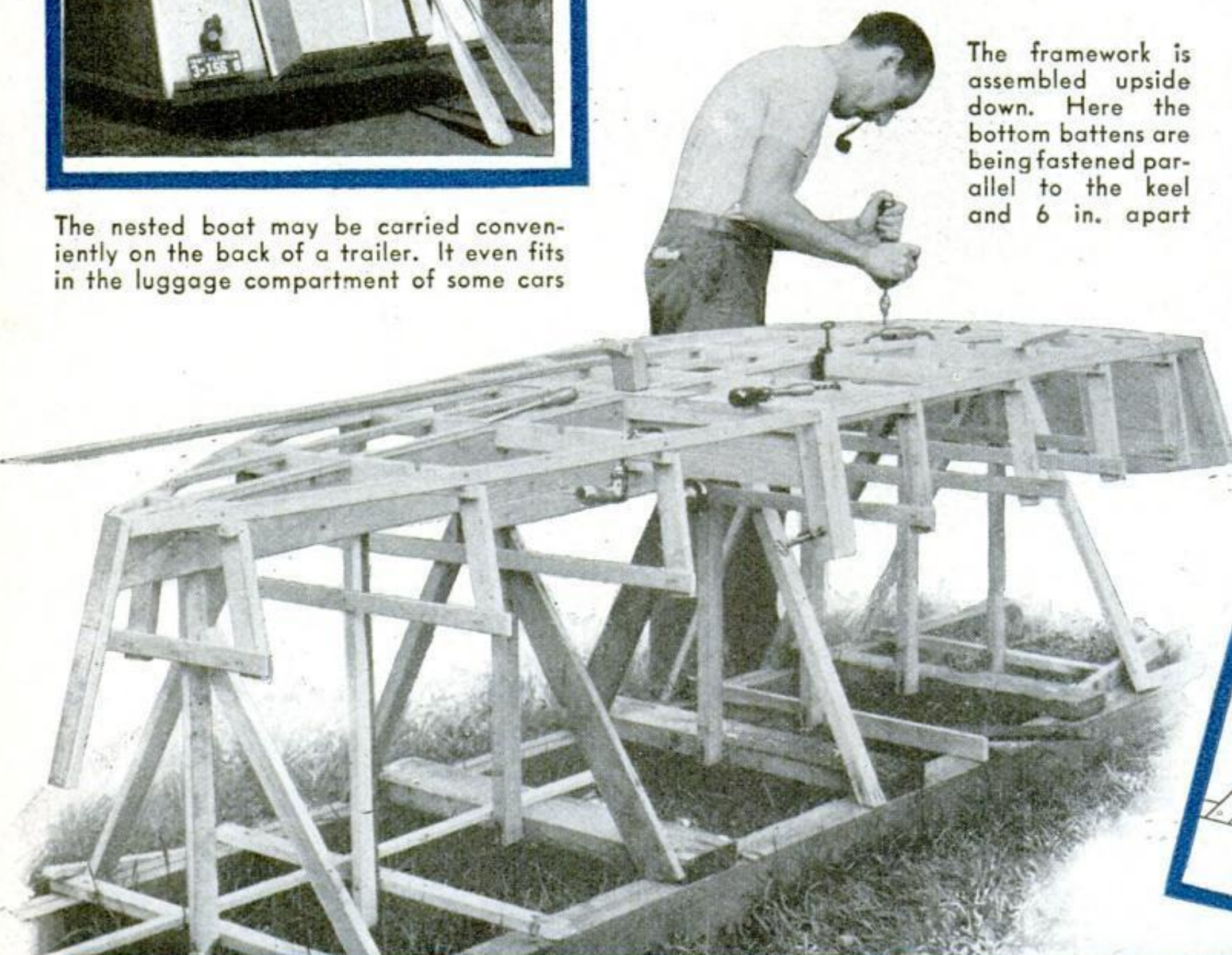


The nested boat may be carried conveniently on the back of a trailer. It even fits in the luggage compartment of some cars

lems. Each section may be lifted and carried separately, and one man can easily handle the heavier section alone.

The cost will range from \$12 to \$18, depending on grade of materials selected and local lumber prices. The weight will depend on the kind and thickness of lumber used. A considerable selection is given in the list of materials. Cedar

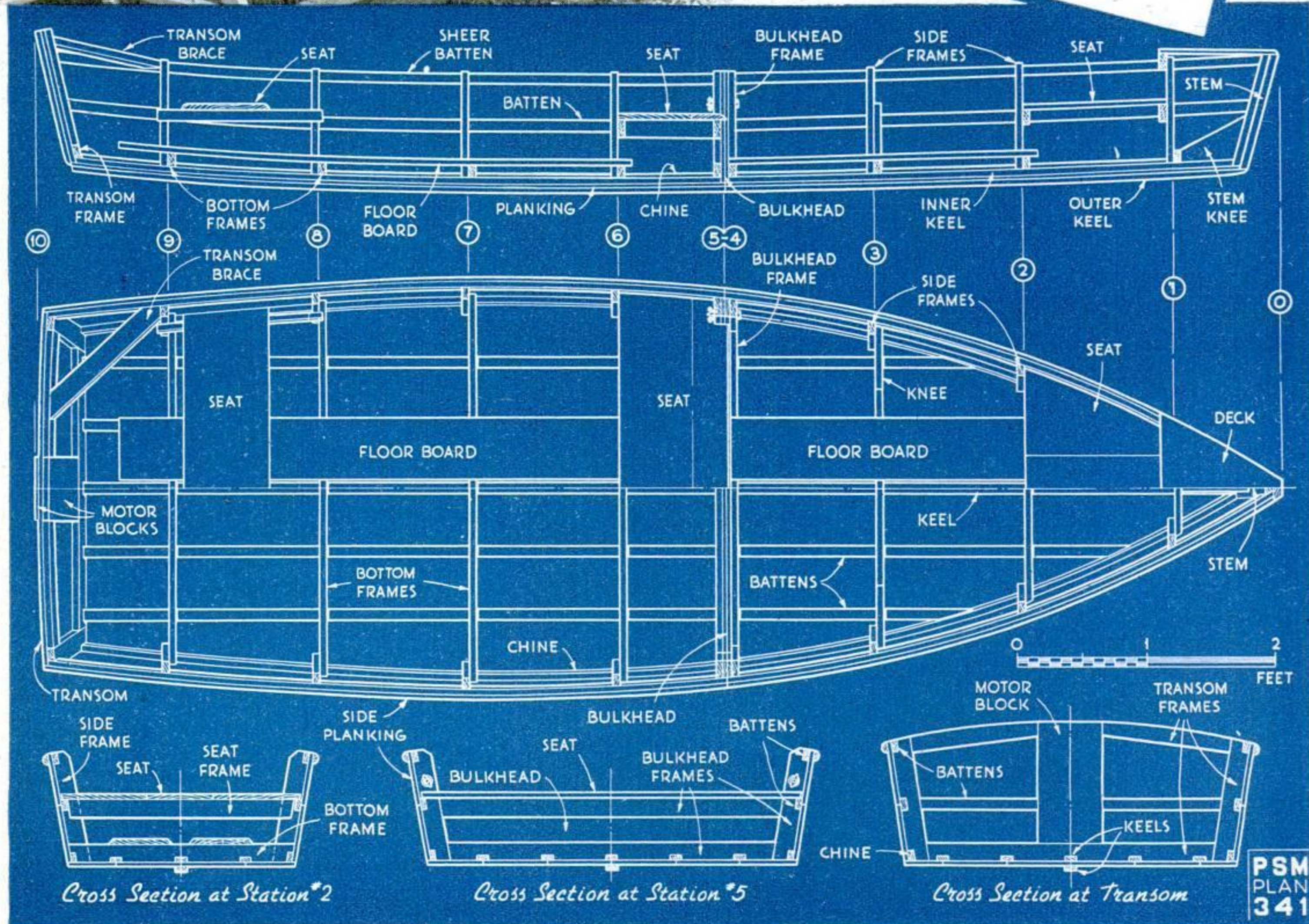
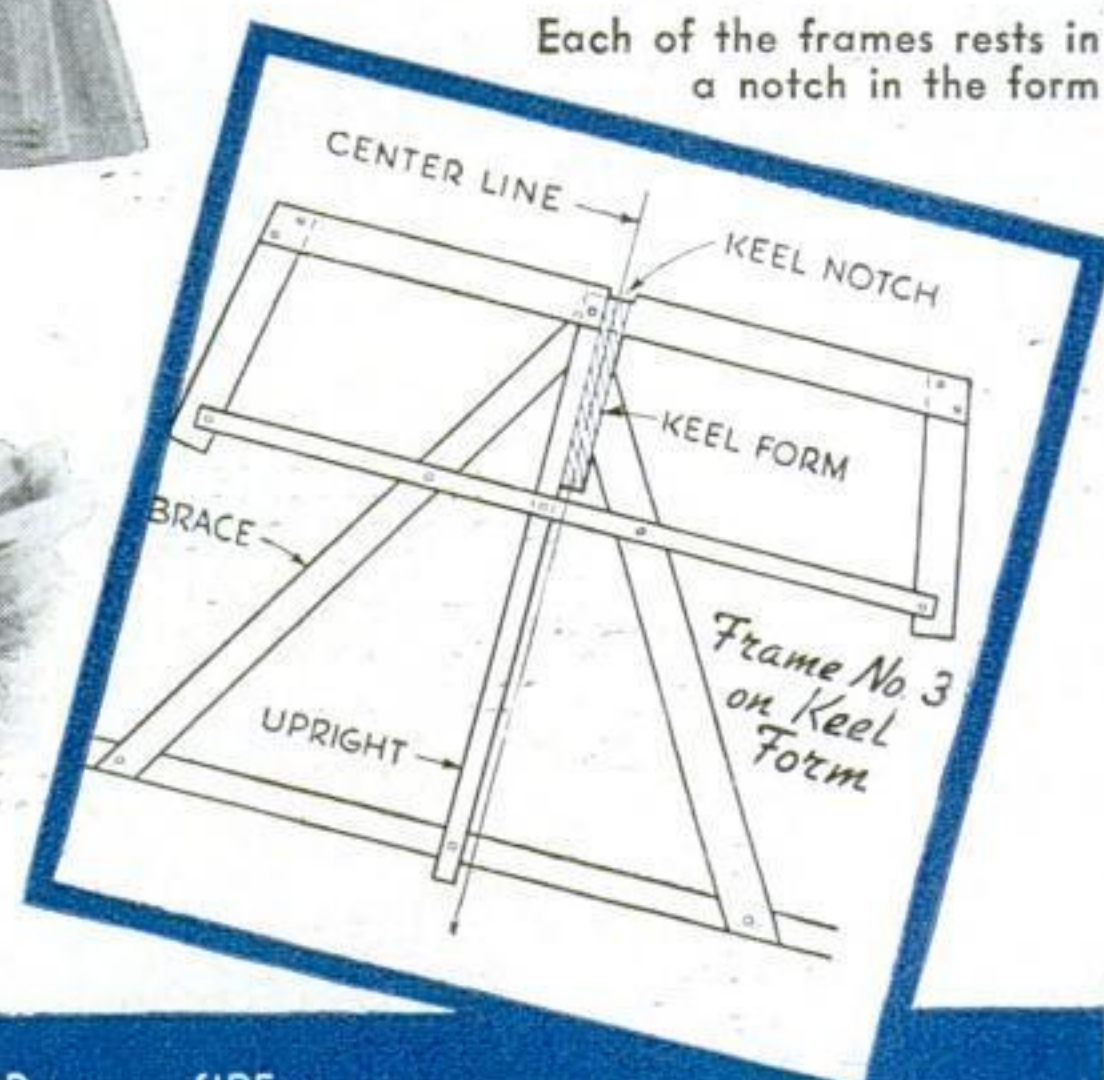
The framework is assembled upside down. Here the bottom battens are being fastened parallel to the keel and 6 in. apart



makes the most satisfactory planking for any light boat. By using cedar throughout with  $\frac{1}{4}$ -in. planking and  $\frac{1}{2}$ -in. framework, the boat can be built to weigh as little as 60 lb. complete, in which case the forward section would weigh about 22 lb. and the rear section 38 lb. A very strong and serviceable boat can be made by using spruce battens and  $\frac{1}{2}$ -in. spruce framework with  $\frac{5}{16}$ -in. cedar planking, making the complete boat weigh about 75 lb. Most of the other materials listed are heavier than spruce or cedar.

The boat may be built all in one piece if desired. In this case a regular frame is substituted for the bulkheads at stations Nos. 4 and 5, and the planks, battens, keels, and chines run the full length of the boat; the knees at station No. 3 can be omitted, and only two

Each of the frames rests in a notch in the form





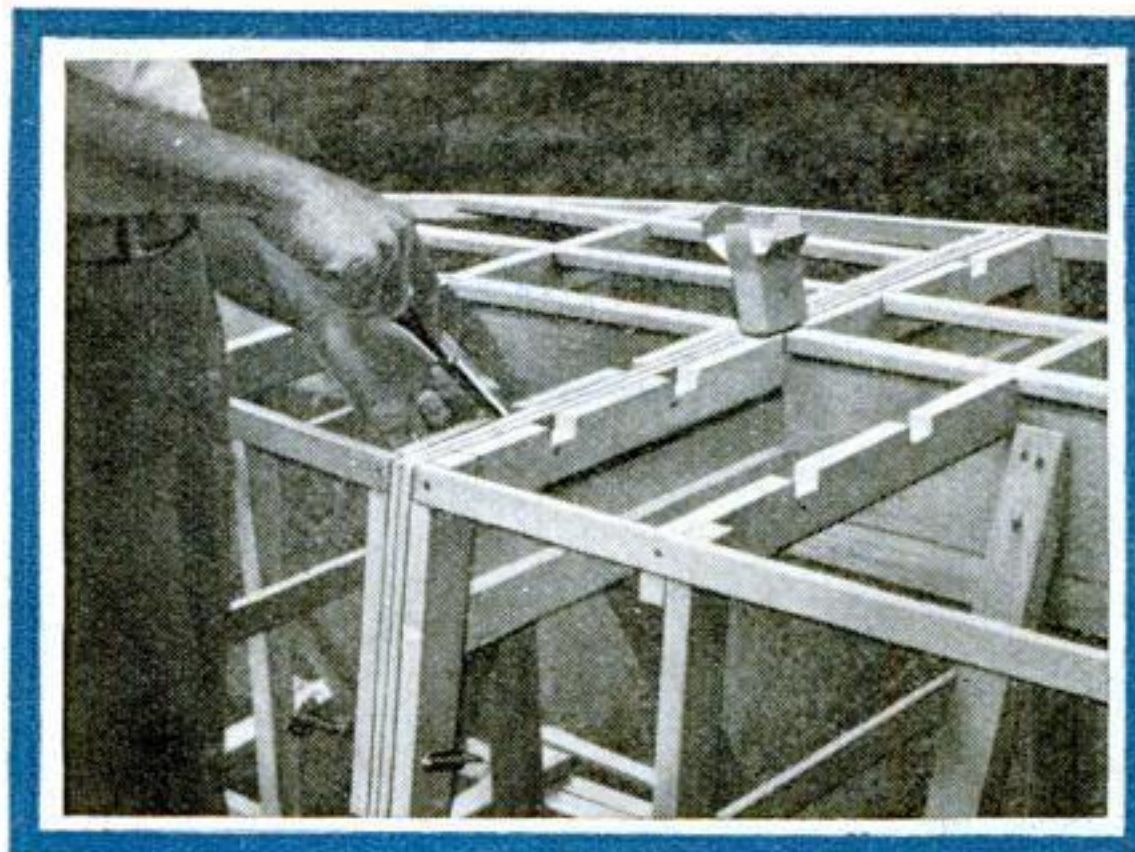
floor boards are used. A simplified construction thus results, and the weight is reduced about 5 lb.

Before starting construction, draw full-size patterns of the frames, bulkheads, and transom on wrapping paper, following the measurements given in the drawings. The measurements in the table of offsets are to the outside of  $\frac{3}{8}$ -in. planking, and it is not necessary to use them at all unless you wish to draw the entire boat full size before making the patterns.

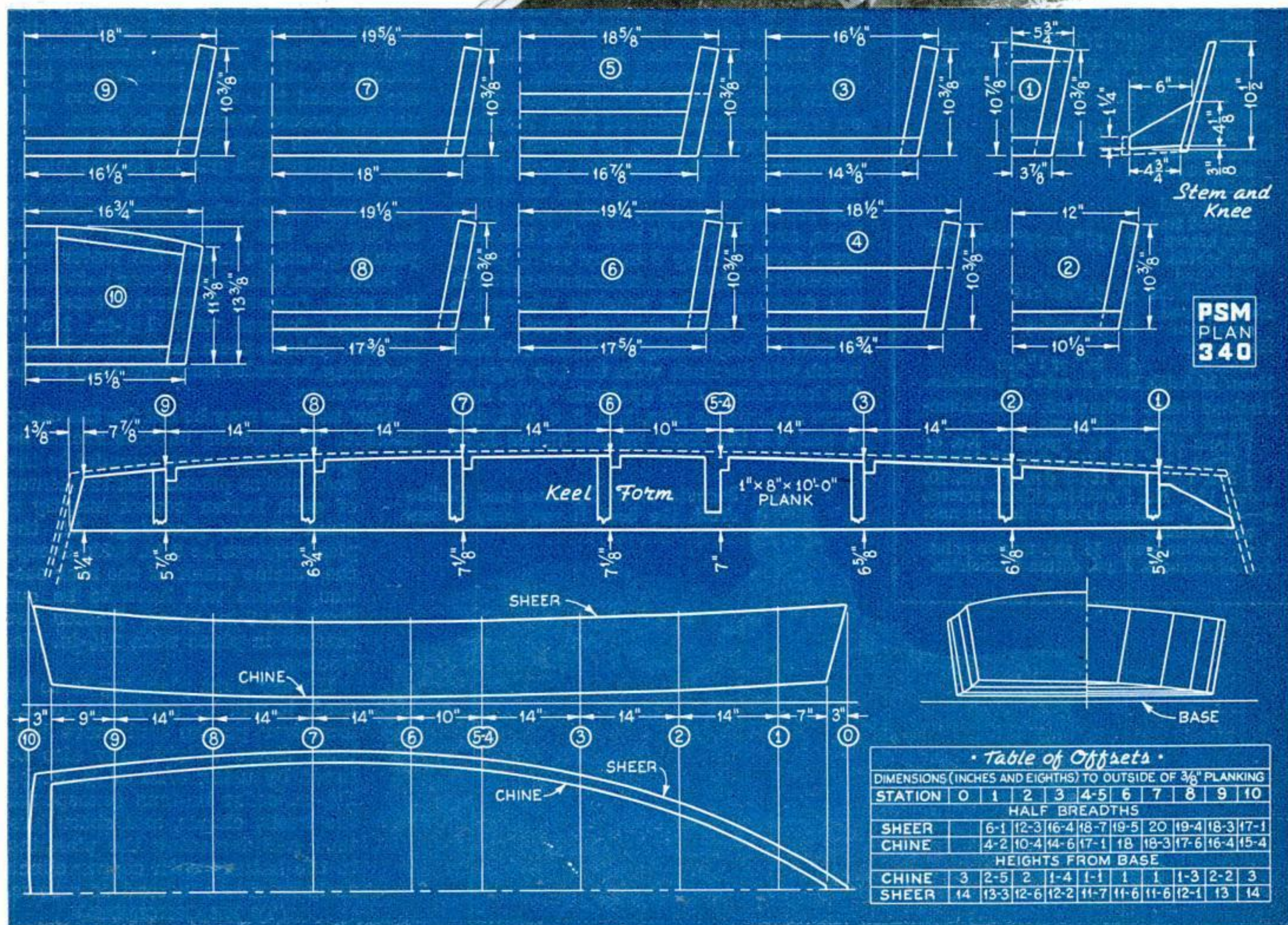
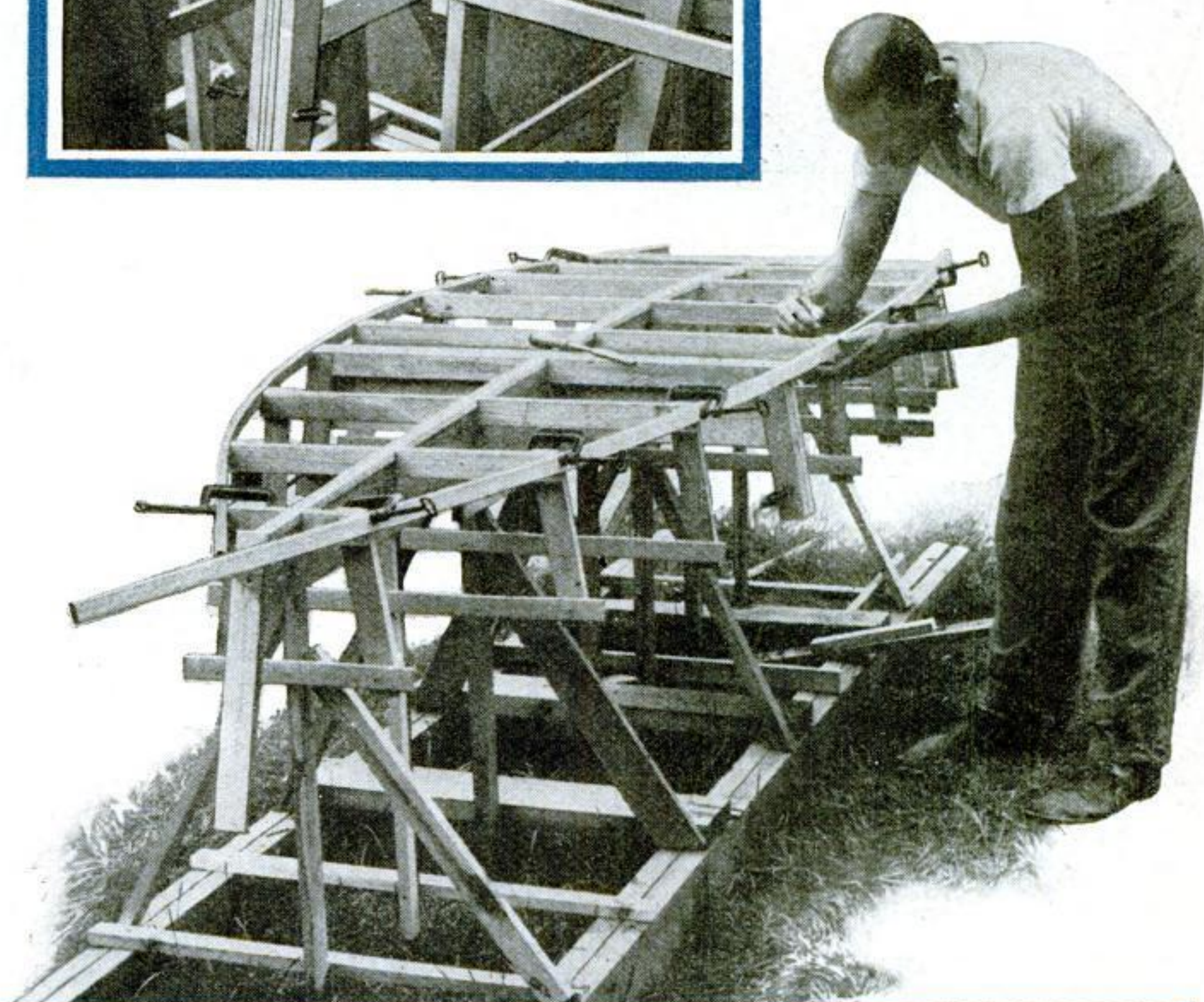
Lay the frame stock over the patterns, mark, and cut to shape; then fasten the frame pieces together over the patterns. The frames may be fastened at the joints with 1-in. No. 8 flathead screws, with  $1\frac{1}{2}$ -in. No. 10 machine screws, or with copper rivets. Allow enough space for the chine notches and for the beveling of the forward frames.

The transom planking should be screwed to the transom frames and inside motor block with  $\frac{3}{4}$ -in. No. 6 screws spaced 2 or 3 in. apart. Coat the surfaces with marine glue before fastening. Secure the bulkhead planking to the bulkhead frames in the same manner. Use planks of 6-in. width for the bulkheads, and one 6-in. and another 8-in. for the transom, covering the seam later with battens on the inside. The outside motor block should be fastened with  $1\frac{1}{4}$ -in. No. 7 screws.

Next nail temporary pieces across the top of the side frames and mark the center line on them and on the bottom frames from the patterns. Also mark the center line on the transom and bulkheads. The stem will be made from two pieces of the

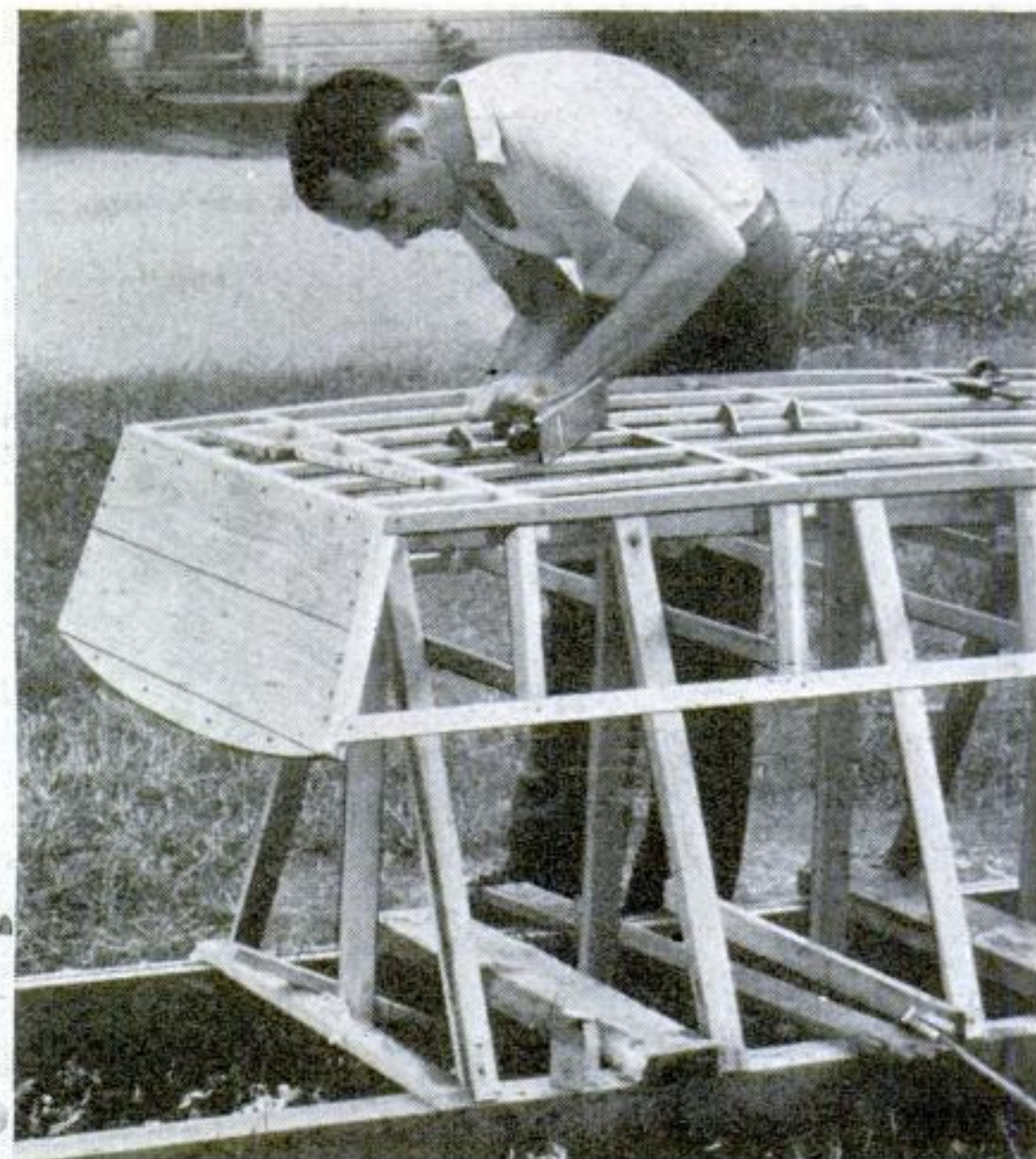
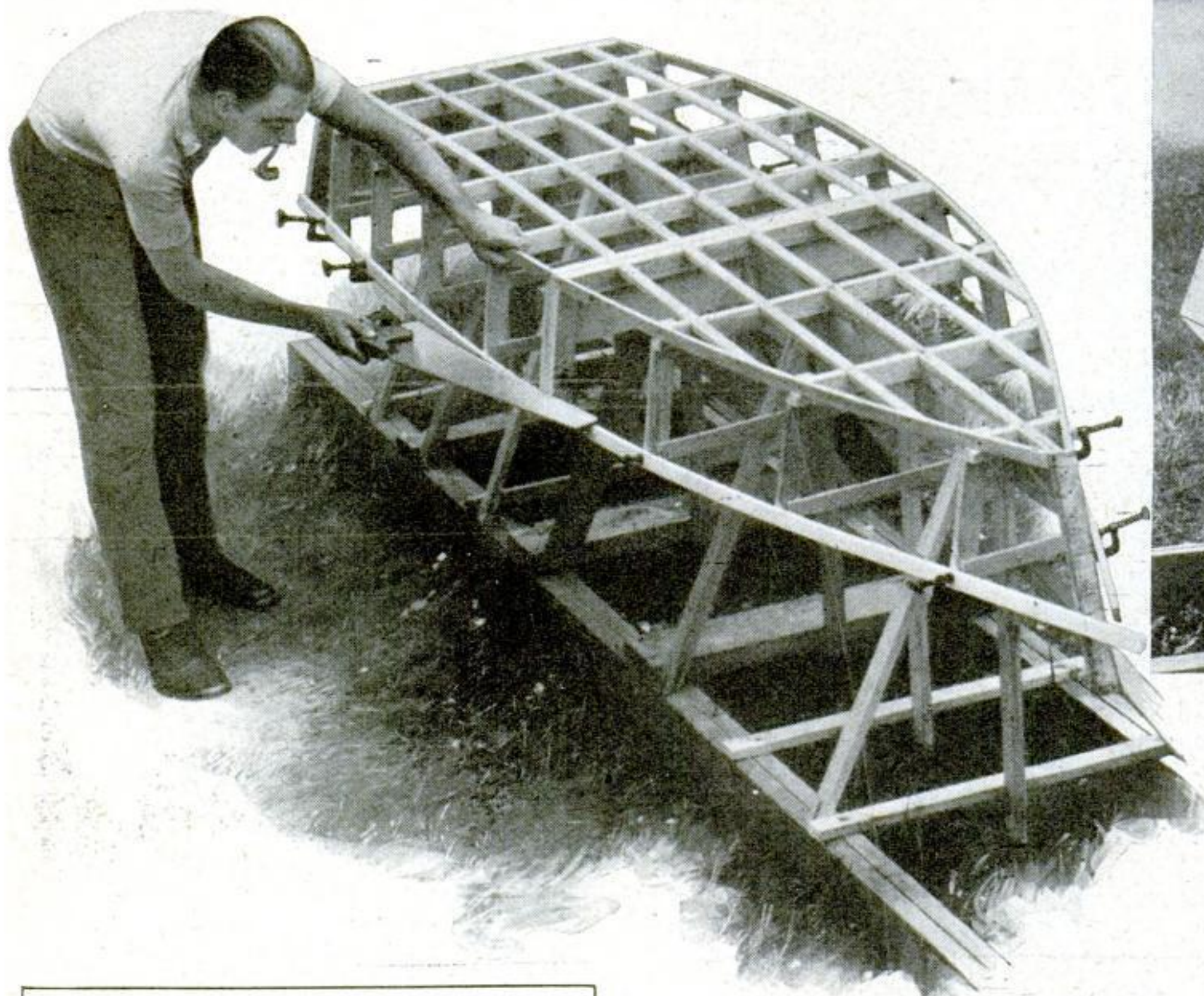


At stations Nos. 4 and 5, where the sections join, notches are cut for battens into the bulkhead frames but not in the planking. Below, clamp a batten in place to get true curves and bevels before cutting chine notches





The side battens, being so far above the water line, may be notched right through the bulkheads and applied in one piece. There is a distinct advantage in doing this because it helps obtain a true curve for the sides



The transom, bulkheads, stem, chines, and all the frames must be beveled and carefully trued up so that the planking will fit with accuracy

### LIST OF MATERIALS

*Cedar, mahogany, cypress, spruce, redwood, fir, white pine, or yellow pine*  
For No. Pc. Size

Planking, deck, transom 9  $\frac{1}{4}$ ", 5/16", or  $\frac{3}{8}$ "x6"x10' and bulkheads 1  $\frac{1}{4}$ ", 5/16", or  $\frac{3}{8}$ "x8"x14'  
*Spruce, cedar, fir, mahogany, oak, cypress, yellow pine, or white pine*  
For No. Pc. Size

Battens, chines, and keels 12  $\frac{1}{2}$ "x1"x10'  
Stem, frames, transom and bulkhead frames, and seat and transom braces 4  $\frac{1}{2}$ " or  $\frac{5}{8}$ "x1 $\frac{3}{4}$ "x16'  
Floor boards, seats, and motor blocks 2  $\frac{1}{2}$ "x6"x14'  
Rear seat and stem knee 1  $\frac{3}{4}$ "x8"x4'  
Half-round molding 2  $\frac{3}{4}$ " or 1"x10'

NOTE: Materials listed in order of preference.  
Flathead brass, galvanized, or cadmium-plated screws as follows:  
7 gross  $\frac{3}{4}$ " No. 6; 2 gross 1" No. 6;  
1 gross 1 $\frac{1}{4}$ " No. 7; 3 doz. 1" No. 8;  
1 doz. 1 $\frac{1}{4}$ " No. 10; 1 doz. 2" No. 10.  
2 doz. 1 $\frac{1}{4}$ " No. 7 oval-head brass screws.  
2—3"x $\frac{3}{8}$ " machine bolts with wing nuts and washers.  
1 pt. marine glue.  $\frac{1}{2}$  gal. marine paint.  
1 pair oarlocks. 2 yd. cotton flannelette.

frame material, the outside piece being screwed on after the boat is planked. Cut the stem knee from  $\frac{3}{4}$ -in. stock and screw the inside stem to it with 2-in. No. 10 screws. Cut notches for the keel in all the bottom frames at the exact center, and also in the bulkhead frames and transom frames, but not into the bulkheads or transom planking.

The boat should be built upside down on framework supported from the floor or from two timbers, as shown in the photographs. The essential part of the framework is the keel form on which the frames, transom, bulkheads, stem knee, and keels will rest. Cut the keel form from a 1 by 8 in. by 10-ft. plank according to the measurements given in the drawings. Cut notches where the frames and bulkheads will rest. They should be deep enough so that each keel notch will be flush with the top edge of the keel form. Nail uprights to the keel form at stations Nos. 1, 2, 3, 6, 7, 8, and 9, and set the form up and brace it at

a convenient height for working. The uprights must be perfectly plumb and at right angles to the keel form.

The inside keels, stem, stem knee, and transom can now be set up. Screw the keel to the stem knee, frames, transom frame, and bulkhead frames with 1 $\frac{1}{4}$ -in. No. 7 screws. Notches for the chines and sheer battens can next be cut into the frames, stem, transom frame, and bulkhead frames. First clamp a batten in place to make sure of getting a true curve and the proper bevels at the chine and sheer lines. The chines and battens should be cut down a little where they are notched into the stem, as too deep notches would weaken the stem. The side battens may be notched through the bulkhead and put on in one piece; this will aid in giving a true curve to the sides. No notches, however, should be cut in the bulkhead or transom planking, except above the water line.

Screw the chines and sheer battens to the stem, frames, transom frame, and bulkhead frames with 1 $\frac{1}{4}$ -in. No. 7 screws. Clamp them in position before fastening, to make sure that they are in a true curve.

Now notches may be cut for the other battens. The bottom battens should be spaced 6 in. apart, parallel to the keel, and so placed that the center of each batten covers exactly a seam in the planking. All the planking can be 6 in. wide except the outside plank of the rear section, which will have to be cut from an 8-in. piece. Fasten the battens in place with 1 $\frac{1}{4}$ -in. No. 7 screws.

If very light planking is to be used, it will be advisable to use narrower planks and more battens. Some weight may also be saved by using 5/16 or  $\frac{1}{4}$  in. by 1 $\frac{1}{4}$ -in. cedar battens (except for the keels, chines, and sheer batten) and fastening the planking to the battens with copper clinch nails or rivets instead of screws.

(TO BE CONCLUDED)

Because of its lightness and shallow draft, the boat is very easy to row





## Easter Eggs Striped While Revolving on a Phonograph Turntable

**A**FTER watching a man in a store window stripe Easter eggs by holding them in a slowly turning lathe and painting them with a brush, my son conceived the idea of revolving the eggs on a phonograph turntable, as shown at the right.

A strip of thick paper about  $\frac{3}{4}$  by 6 in. is formed into a band about 1 in. in diameter and fastened with paste. This collar is then centered over the end of the turntable, and the egg placed vertically on top. Ordinary water colors applied with a No. 6 or 8 water-color brush are suitable for striping the eggs. The turntable is run at a slow speed.

Grown-ups as well as children find enjoyment in striping the eggs, and it is surprising how many beautiful designs can be turned out in a very short time.—GEORGE A. CHATTERTON.



The egg is supported over the center of the turntable by a collar made from a paper strip



A flame can be applied directly to the tray to melt the tin, and a soldering iron distributes it

## How to Recoat Worn Tin Kitchen Utensils

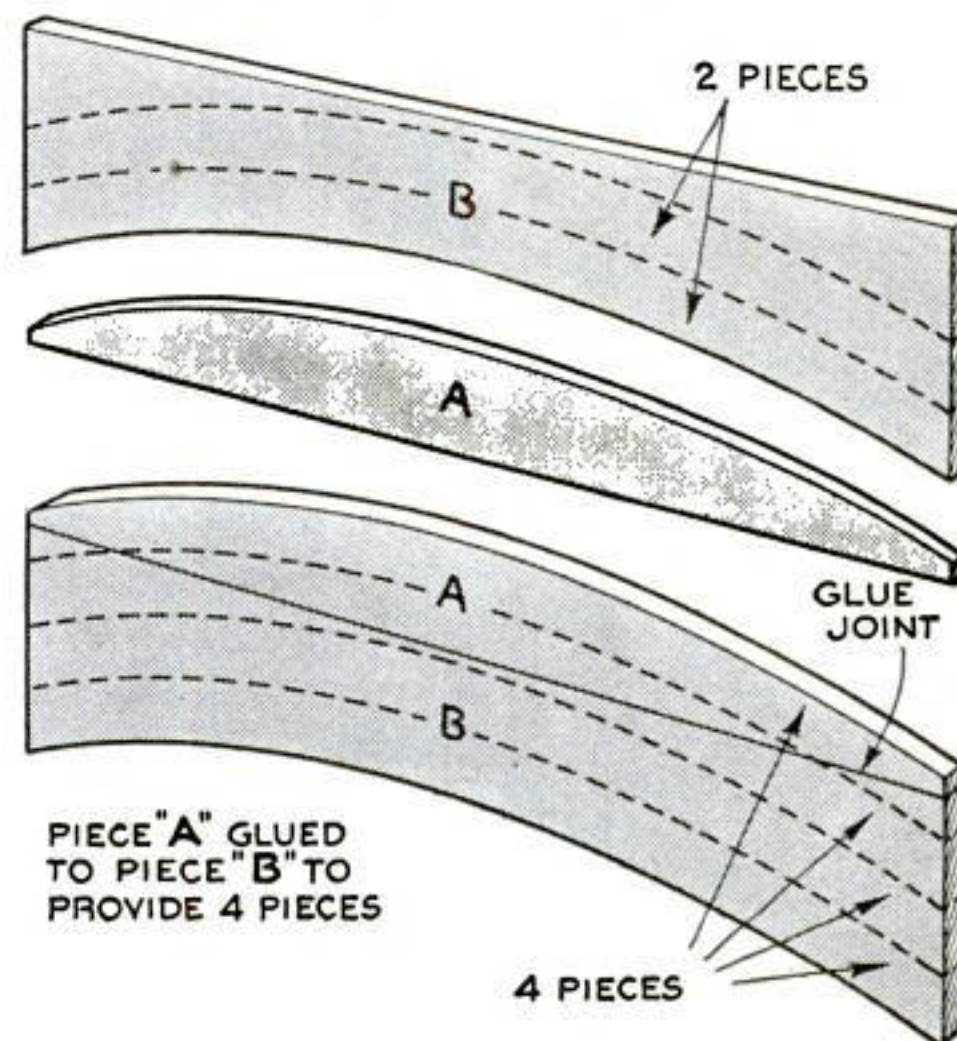
OLD kitchen utensils and refrigerator ice-cube trays of the type made of copper or other metal and heavily coated with tin become worn in time so that the base metal is exposed. They can usually be retinned without difficulty by using pure block tin (not tin-lead solder). The examples shown above are trays from a 1927 mechanical refrigerator.

Clean the utensils thoroughly with emery cloth before attempting to ap-

ply the tin. Solid zinc chloride crystals should be used as a flux. A Bunsen burner or a gasoline torch will serve to heat the tin lumps, which can be placed in the tray together with solid zinc chloride. The free flame of the burner or torch can also be used directly to heat the tray on the edges. A hot soldering iron, free from tinner's solder, is then used to flow or sweat the tin on the surface.—R.W.

## Cutting Wooden Arcs with Little Waste

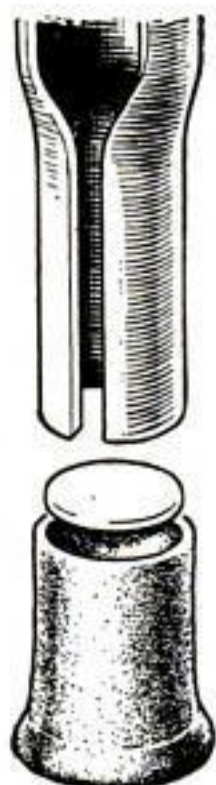
WHEN segmental pieces of wood are required for the arc of a trellis, arbor, screen, or other curved work, considerable lumber can be saved by gluing the piece sawn from the inside of the arc to the opposite side of the board, as shown below. This will provide at least one extra piece.—HARRY ROSENBERG.



The piece sawn from the inside of the arc is glued to the opposite side of the board

## Reinforcing Tips of Iron Chair of Iron Chair

RUBBER tips that slip on the legs of iron chairs and stools will last much longer, and the edge of the iron will not cut through and damage the floor or linoleum, if a round metal plate is inserted between leg and rubber. A washer of the correct size can be found in most cases, but sometimes a one-cent piece will serve the purpose. To make a firmer job, the piece of metal can be soldered to the leg so it cannot slip.—WILLY IDSTEIN.



## Soldering Iron Melts Battery Compound

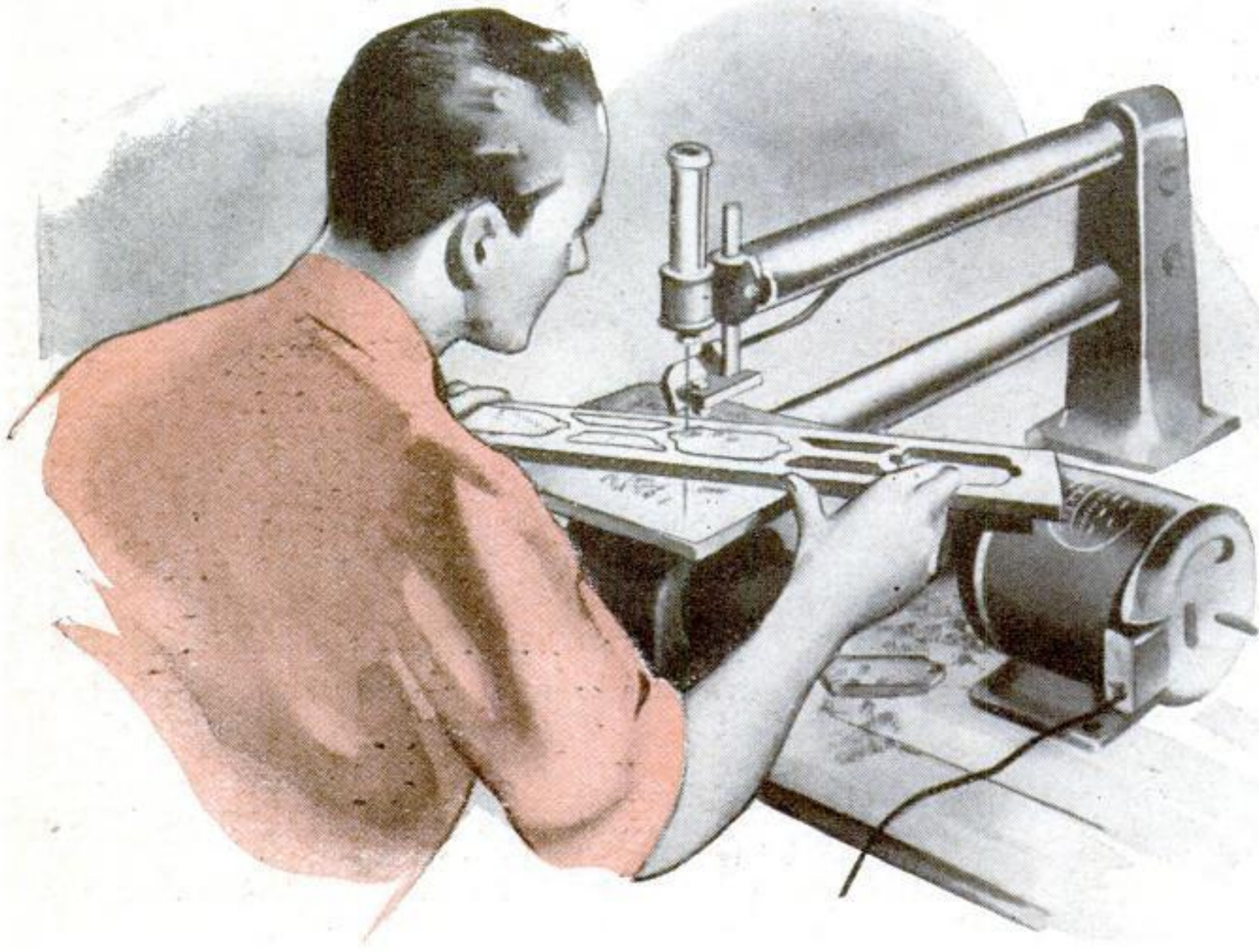
BY USING an electric soldering iron supplied with a reflecting sheath, the compound around the cell tops of a storage battery can be easily removed when repairs are necessary. The sheath is made from a strip of tin the width of the bit head. A sheet of asbestos is applied over the outside of the strip after it has been shaped, and is fastened by crimping over the edges of the tin. The tool is moved along the outlines of each cell as shown. This method is safer than using a naked flame and much quicker.—W.C.W.



A tin sheath is bent to fit an electric soldering iron and covered with asbestos. This deflects heat down on the battery



# BEST IDEAS OF THE MONTH FOR Furniture and



## Fretwork Legs and Gallery Railing Ornament This Small Table

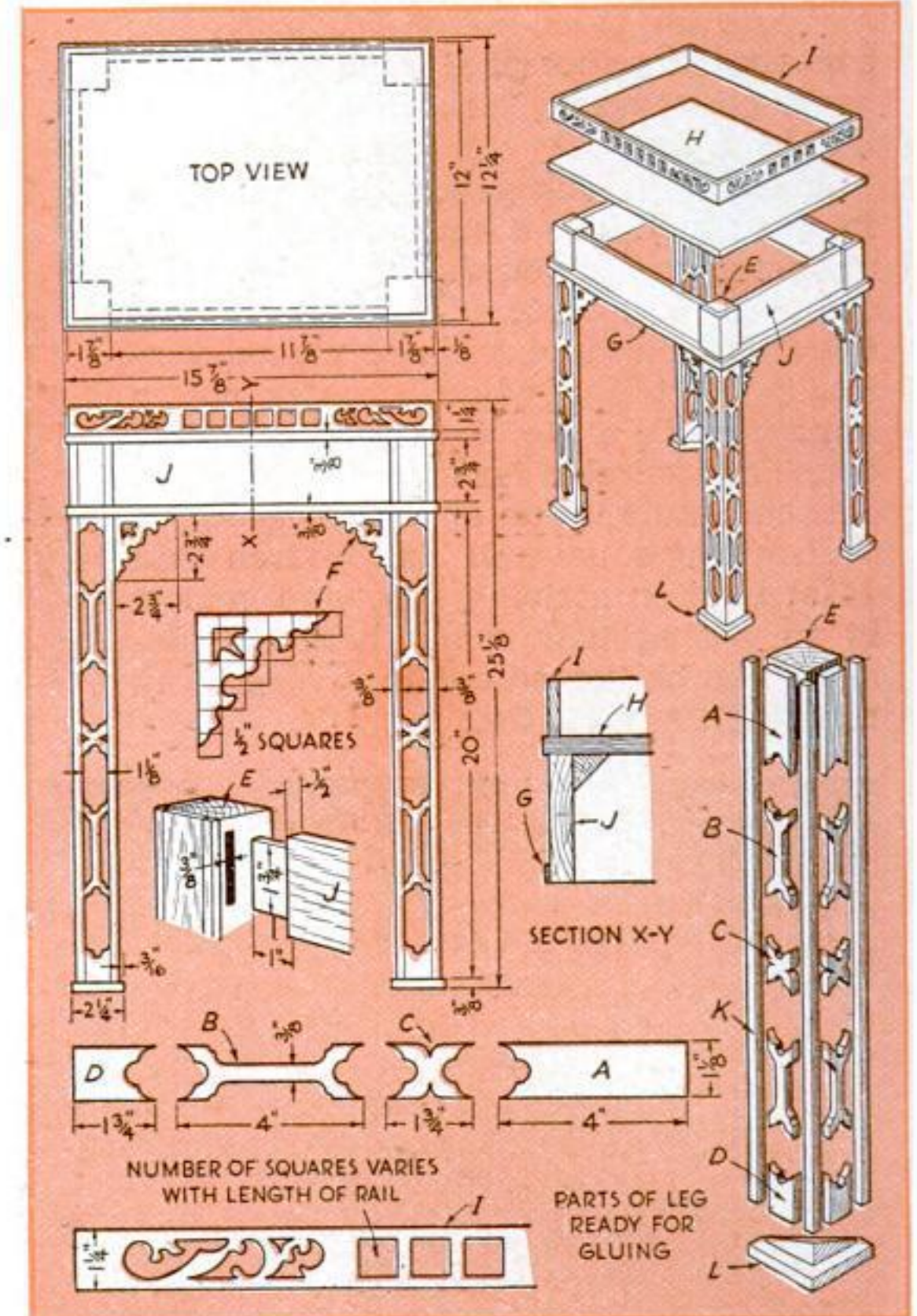
SCROLL-SAW work appears to unusual advantage in this occasional table, which has enough Chippendale lines about it to give it a place in any well-appointed home.

Obtain the materials listed at the end of the article and prepare heavy paper patterns of all the odd-shaped parts. Cut parts A, B, C, and D with a jig saw or coping saw, smooth them with sandpaper, and assemble with the leg strips K as shown to form the four legs. Since the edges of the legs are slender square rods, lay pieces of heavier wood along each and use several small hand screws to provide uniform pressure when gluing the parts together. When dry, go over the legs with plane and sandpaper. (If preferred, one side of each leg can be jig-sawed from one piece as shown above.) Glue base blocks L and pine head blocks E in place.

Make the side rails J, two  $8\frac{1}{4}$  in. and two  $11\frac{7}{8}$  in. between the shoulders of the tenons. The tenons may be  $\frac{3}{8}$  by  $1\frac{3}{4}$  in., and 1 in. long, cut flush on the rear side of the rail, or so the outside of the rail will be set back  $\frac{1}{8}$  in. from the outside of the leg when in place. The mortises in the legs must match the tenons, and the joints should fit snugly.

Band G is notched and fitted to each side at the bottom of the rails, the corner joints being mitered.

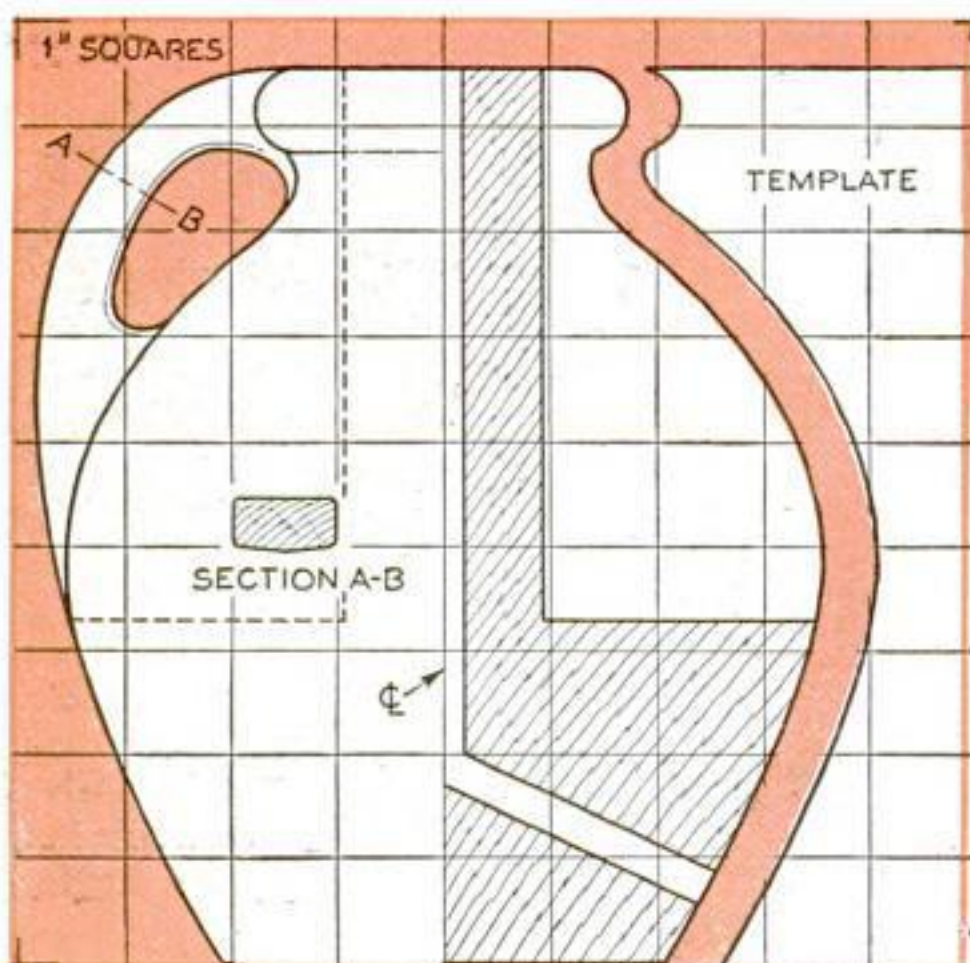
While the top may be (Continued on page 115)



The drawings of the table, and details showing the built-up construction. At right, the finished piece. Below, base block used at bottom of leg



## Vaselike Lamp Turned from Wood and Finished to Resemble Pottery



ALTHOUGH it resembles pottery, the "vase" used for this highly decorative table lamp is made of wood.

The handles, which are attached after the lamp has been turned, are set into recesses, and these must be prepared at the time the stock is glued together. To insure a tight fit, it is advisable to work out the material for the handles at the same time. They are made from 1-in. thick wood, so in preparing the stock for the vase, have the center layer of the material 1 in. in thickness. Before the vase is turned, these recesses should be blocked up with extra pieces of stock. Do not, however, set the fillers in the stock at the time the material is glued together because sufficient glue will be pressed out while clamping to hold the (Continued on page 107)



# Woodworking Projects

## Smoking Stand of Ship's-Wheel Design

WITH its top shaped like a ship's wheel, this small smoking stand has a distinctive nautical look. It may be made of maple or red gumwood. The latter is much easier to work, and will finish slightly darker than maple—a richer, softer color.

The 9-in. base and 8-in. top are faceplate turnings, 1 in. thick. Bore a 1½-in. hole in the center of the base and three equally-spaced 1-in. holes at a 10-deg. angle to fit the legs. Note that the legs protrude up through the base and are rounded off. Around the edge of the top, mark off six equidistant centers where ½-in. holes are to be drilled, and in the underside bore a 1-in. hole to a depth of ¾-in.

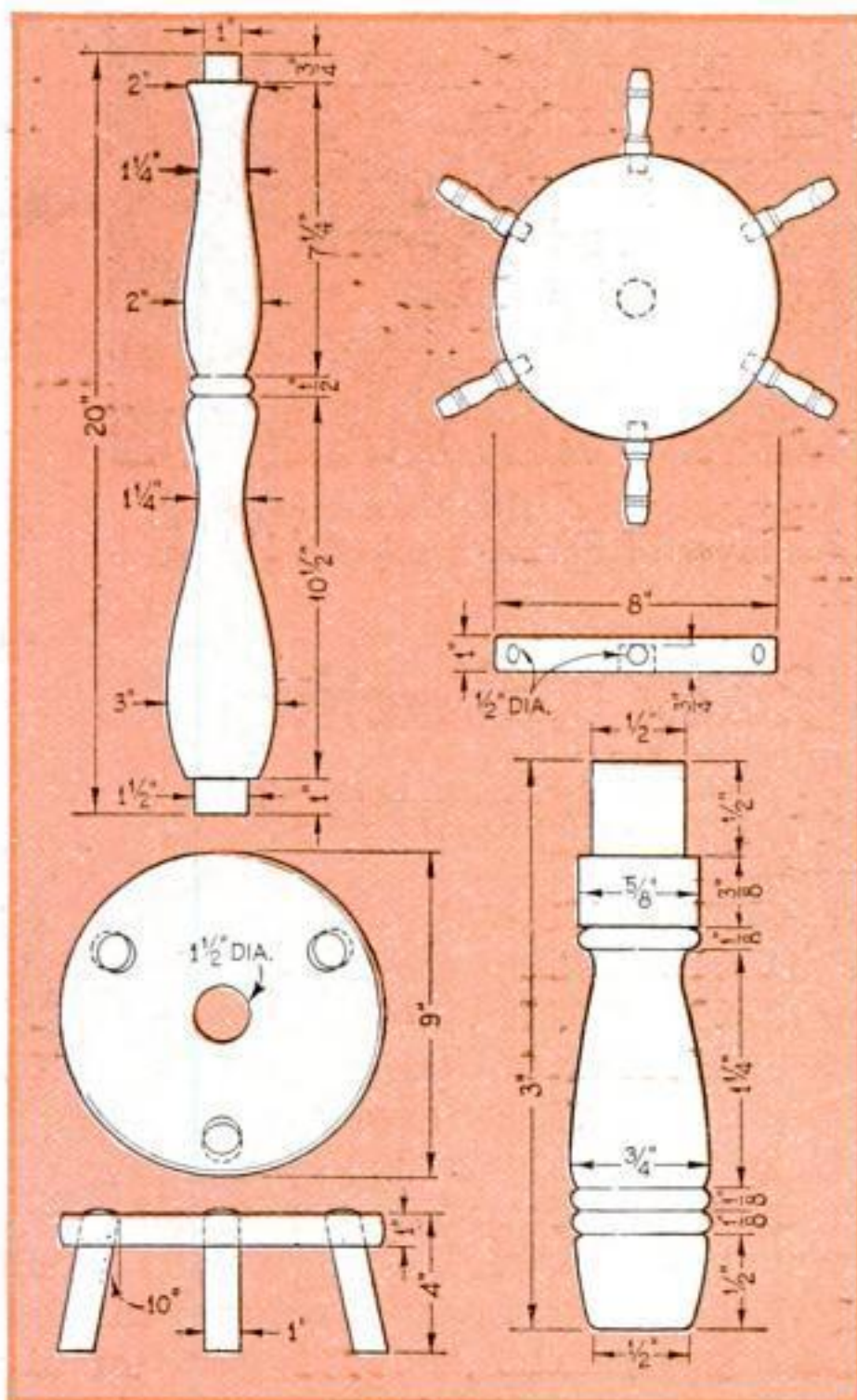
Now turn the legs, which may be varied in design to suit the taste. In turning the pedestal and the wheel handles, it is wise to cut a cardboard stencil of the reverse outline of one side of the pattern.

Finish the parts while revolving in the lathe. For this purpose, make a pad of several thicknesses of stiff cloth, being sure that there are no ends or threads loose to catch in the revolving piece. Saturate the surface of the pad well with orange shellac, or, if you are

using red gumwood, you may prefer white shellac. Do not allow too much shellac to saturate the surfaces that are to be glued; in fact, the glue will stick much better if you take a shaving off these surfaces before assembling the parts.

For the top of the stand, an effective finish is a nautical print, cut to a

diameter of about 7 in. and coated on the back with white shellac. Lay it on the shellacked stand top and rub lightly with a cloth until you can see that the shellac has become tacky. Then coat the entire top with a heavy coat of white shellac. When thoroughly dry, polish the surface with powdered rottenstone and oil.—W. J. GEE, JR.



Wood turners have their inning with this sturdy little smoking stand, for every part is a product of the lathe

## Child's Sewing Cabinet Tells Story of Mary and Her Little Lamb



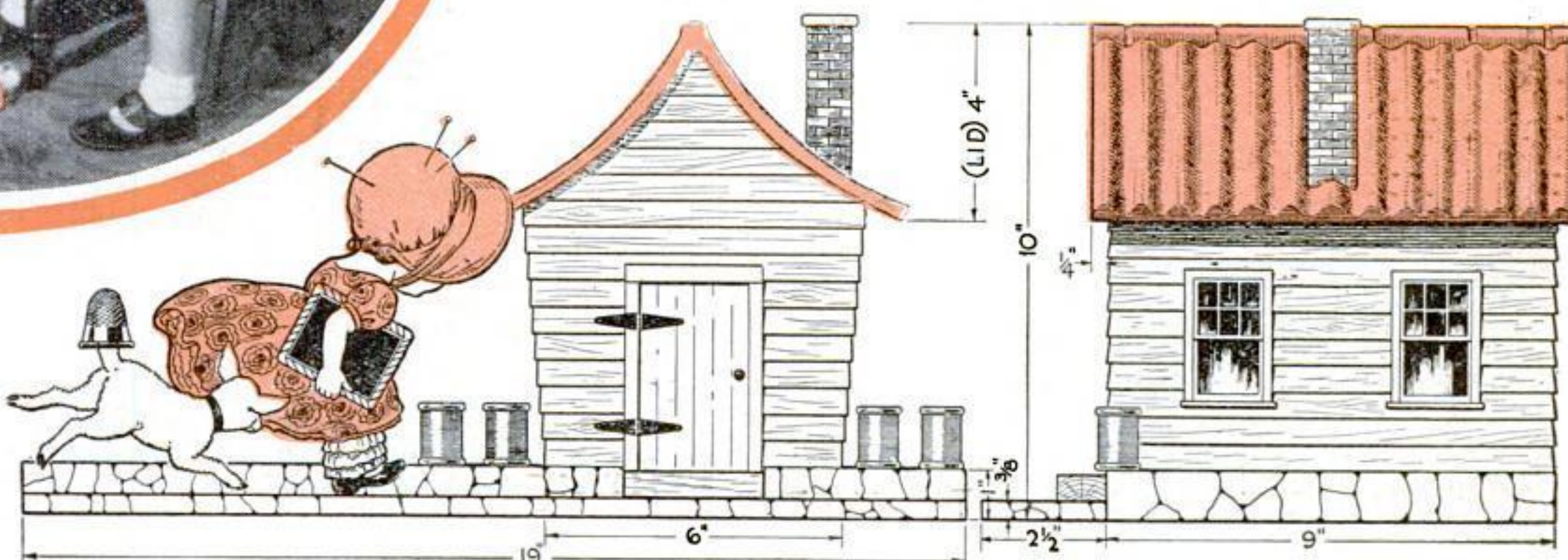
Little girls who like to sew will have an added incentive in this picturesque box, designed to hold sewing materials. Spools of thread are kept handy on four nails driven into the curbing along the sidewalk

MARY had a little lamb that followed her to school, but in this case the schoolhouse turns out to be a novel sewing cabinet for dolly's dressmaker.

The schoolhouse is of thin wood or plywood, and of course it must not be quite square because nursery-rhyme pictures are not made that way. The roof should be single-ply thin wood so that it will bend to the required curve. Two curved cleats on the underside of the lid will hold it in shape. The lid is hinged on the side opposite the chimney, and the latter serves as a handle for raising it.

For an extra touch, the grooves in the siding where the boards overlap, the planks of the door, the bricks in the chimney, and the tiles of the roof can be marked by hand or with cutters used in a high-speed flexible shaft.

Mary and her lamb are cut from plywood, as is the sidewalk. The curbing provides a good [\(Continued on page 115\)](#)

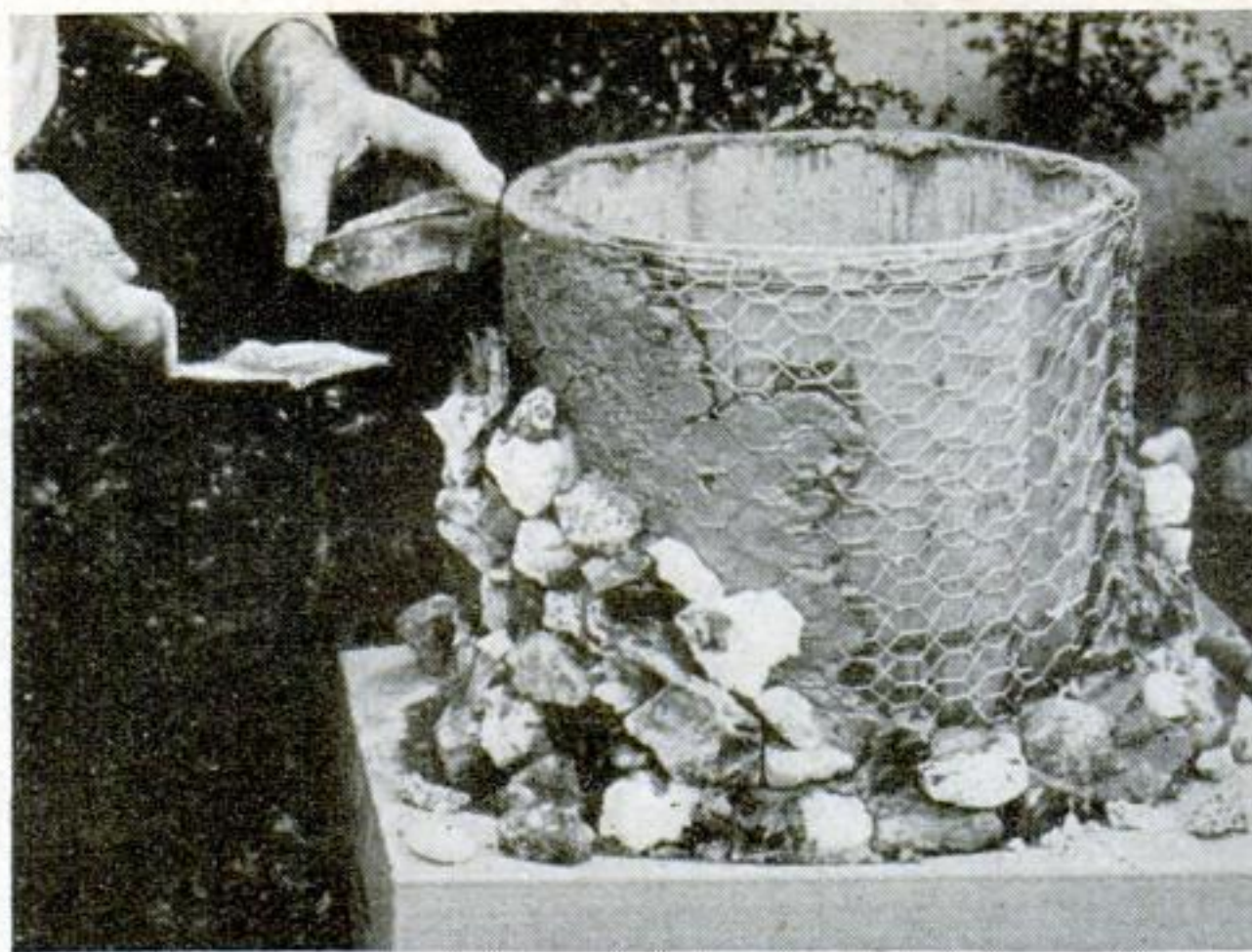






## Broken Bicycle Rolls on a Skate Wheel

WHEN the front tire of a bicycle will not hold air or the wheel itself is damaged, a roller skate may be strapped or tied to the rim as illustrated so that the bicycle can be pushed or even ridden to a repair shop, if care is taken.—R. D. KERSHNER.

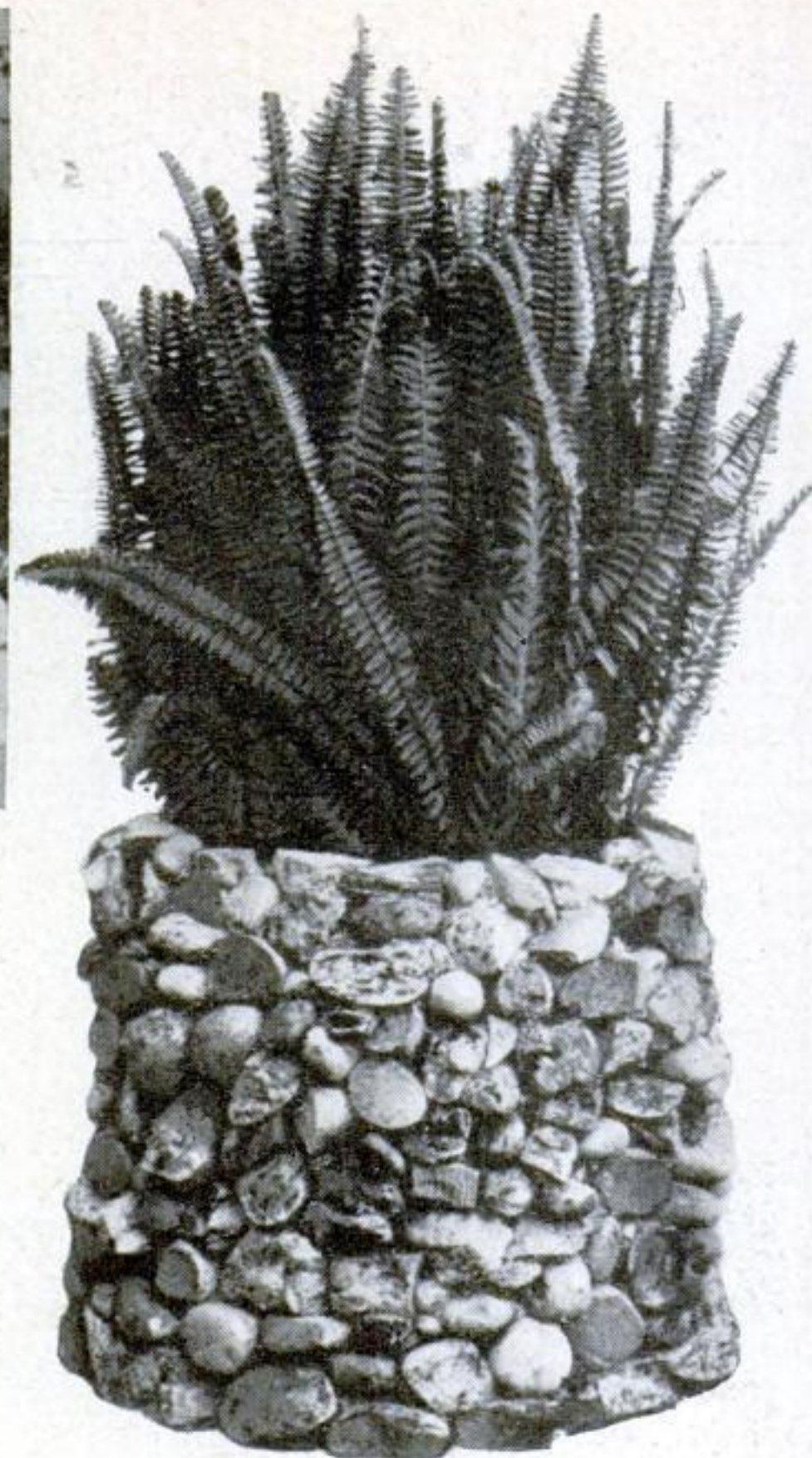


A wooden keg is cut down, covered with chicken netting, then with concrete and a layer of decorative-looking rocks

## Attractive Rock Collection Covers Large Flowerpot

SMALL, attractive-looking rocks, such as you may have picked up on your rambles for the purpose of starting a geological collection, can be put to a picturesque use by embedding them in what I call a "geological flowerpot" for the garden. The general method is illustrated in the photograph above, where all layers are shown. In the actual construction, of course, the netting is entirely covered with concrete before any rocks are put in place.

Cut down a wooden nail keg or some other sturdy, barrel-shaped container to the size wanted and fill the bottom with concrete, leaving a drain hole. Around the outside, nail some chicken netting, and let the staples protrude for additional reinforcement. Over this, place a rich mixture of concrete—about 1 part cement to  $1\frac{1}{2}$  sand, and sufficient water to give a rather stiff consistency. Roughen the surface well and let the whole dry.



When thoroughly hardened, apply another layer of concrete from the bottom up about 3 in. Push the rocks into this, and tamp them with the trowel. Scoop off any excess, and when the pot is completely girdled, come up another 3 in. with a similar layer.

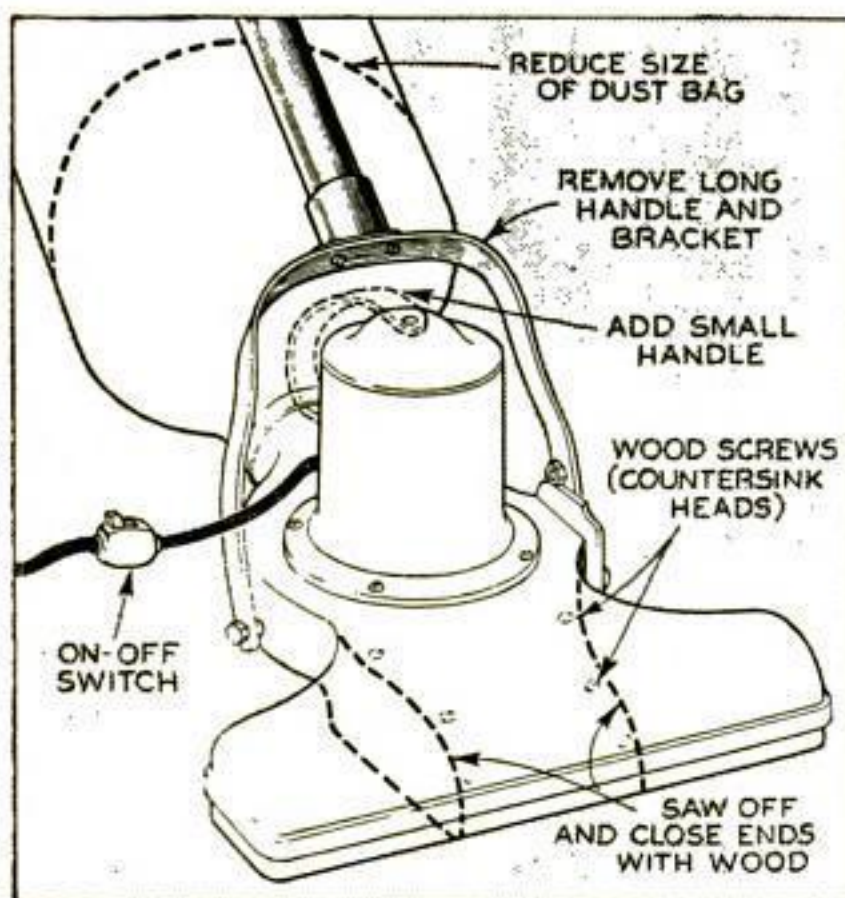
After completion, be sure to keep the flowerpot covered for three or four days with a wet sack. Excessive cement can be removed with a cold chisel. A colorless varnish may be applied when the surface is completely dry to preserve the luster.—MARSHALL PERHAM.

## Old Vacuum Cleaner Cut Down in Size for Removing Dust in an Auto

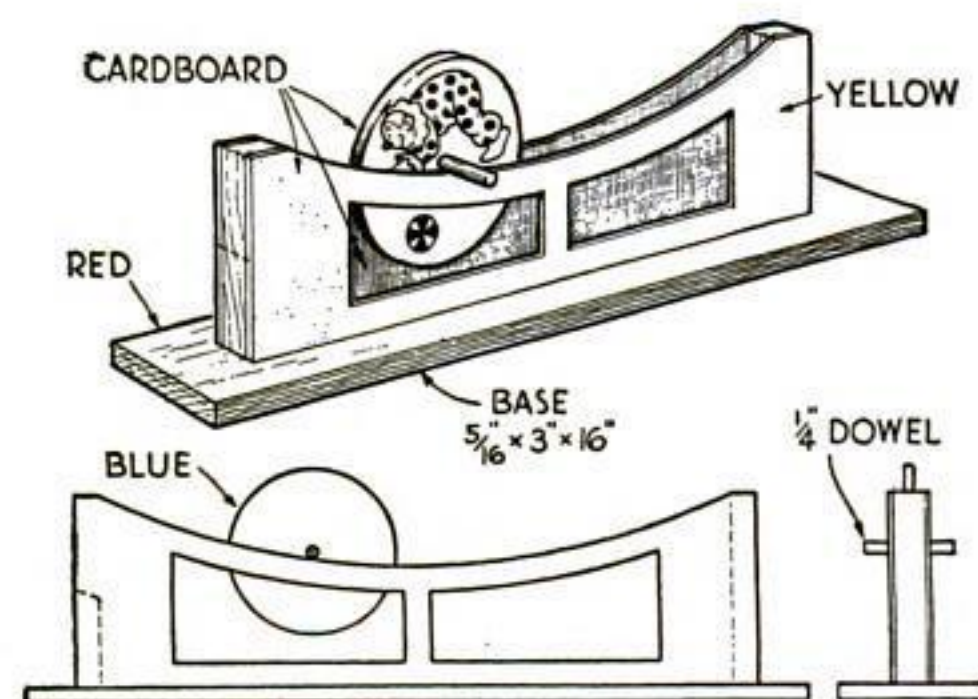
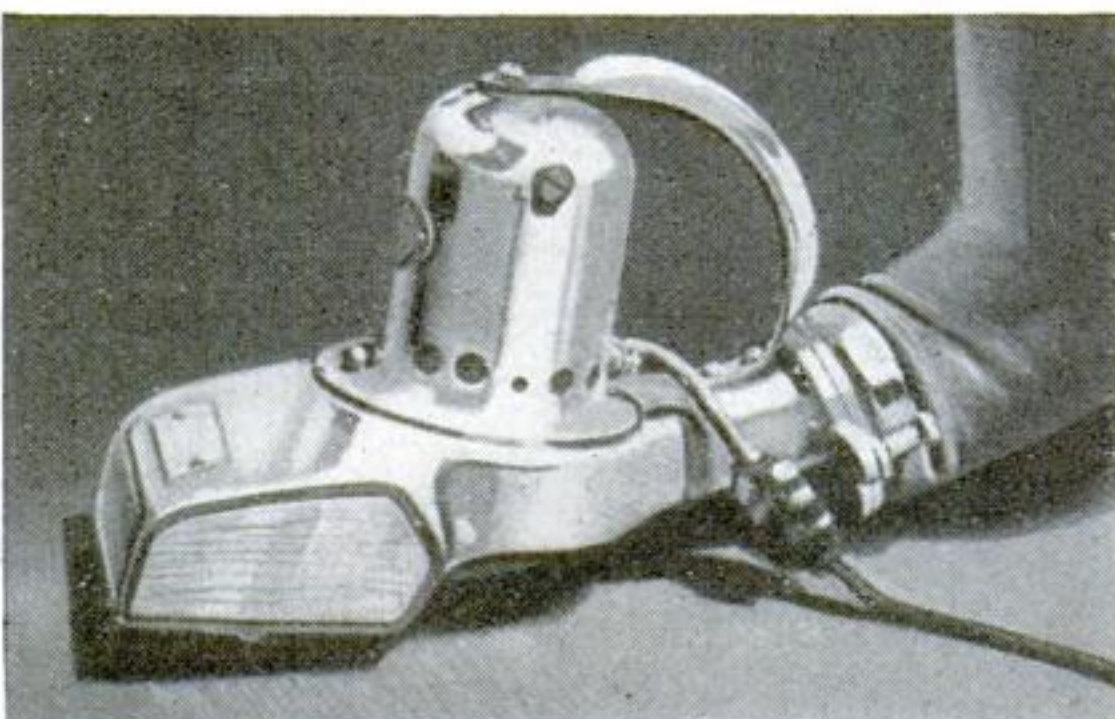
A DISCARDED vacuum cleaner, if in reasonably good working condition, can usually be converted without much work into a small

hand cleaner to be kept in the garage for cleaning the inside of the automobile, or it can be used for cleaning furniture.

The ends of the old cleaner are cut off with a hack saw where indicated by the dotted lines in the drawing, and the ends are closed with wood. The long handle and bracket are removed, and a small handle, bent from flat steel bar, is tapped and bolted to the housing. The dust bag is cut and sewn into a bag about the size of a football. A switch is inserted in the cord as shown.—AXEL E. OGREN.



The changes made in the discarded cleaner. When remodeled as a small hand cleaner, it appears as at right and gives good service



## A Tumbling-Clown Toy for Small Children

THE rolling-clown toy shown above has only seven parts, four of wood and three of cardboard. By taking hold of the disk axle with thumb and finger of both hands and spinning the disk, the clown can be made to roll back and forth on the incline several times before coming to a stop. If both end blocks are made shorter, as suggested by dotted lines at left, the disk will travel a little farther. Paint the clown on the disk or use some other figures, if preferred, such as a dog running after a cat.—IRWIN PFEIFER.



# Switches and Track Layouts

## FOR HO-GAUGE MODEL RAILWAYS

By Harold V. Loose

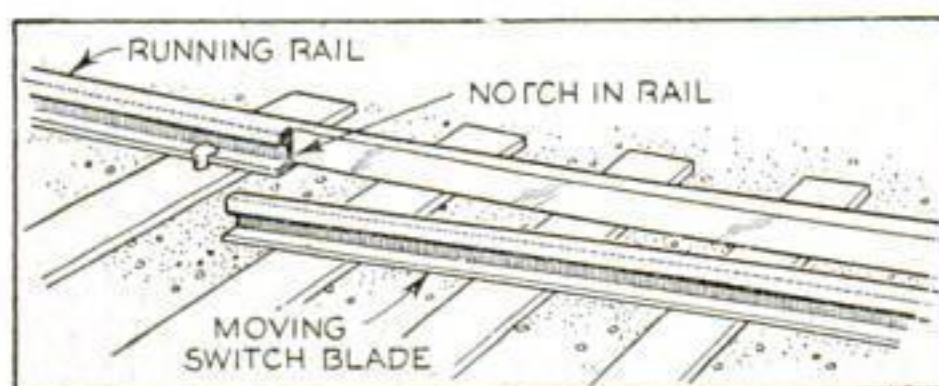
ONCE you understand the general method of laying rails for an HO-gauge model railroad as outlined in a preceding article (P.S.M., Mar. '38, p. 82), you are ready to consider the track switches. These may be purchased, but building them is fun, and not as complicated as it seems.

Two drawings for switches are given below. The first one looks quite realistic, but requires guard rails to be fitted opposite the frog as shown. The writer uses a slightly different type of switch, as in the second drawing. It is not quite as realistic, but works better. The frog is made in one piece with the blade and closes up when the switch is thrown, eliminating the possibility of derailment. Guard rails are not necessary, although they may be included for the sake of appearance, if desired.

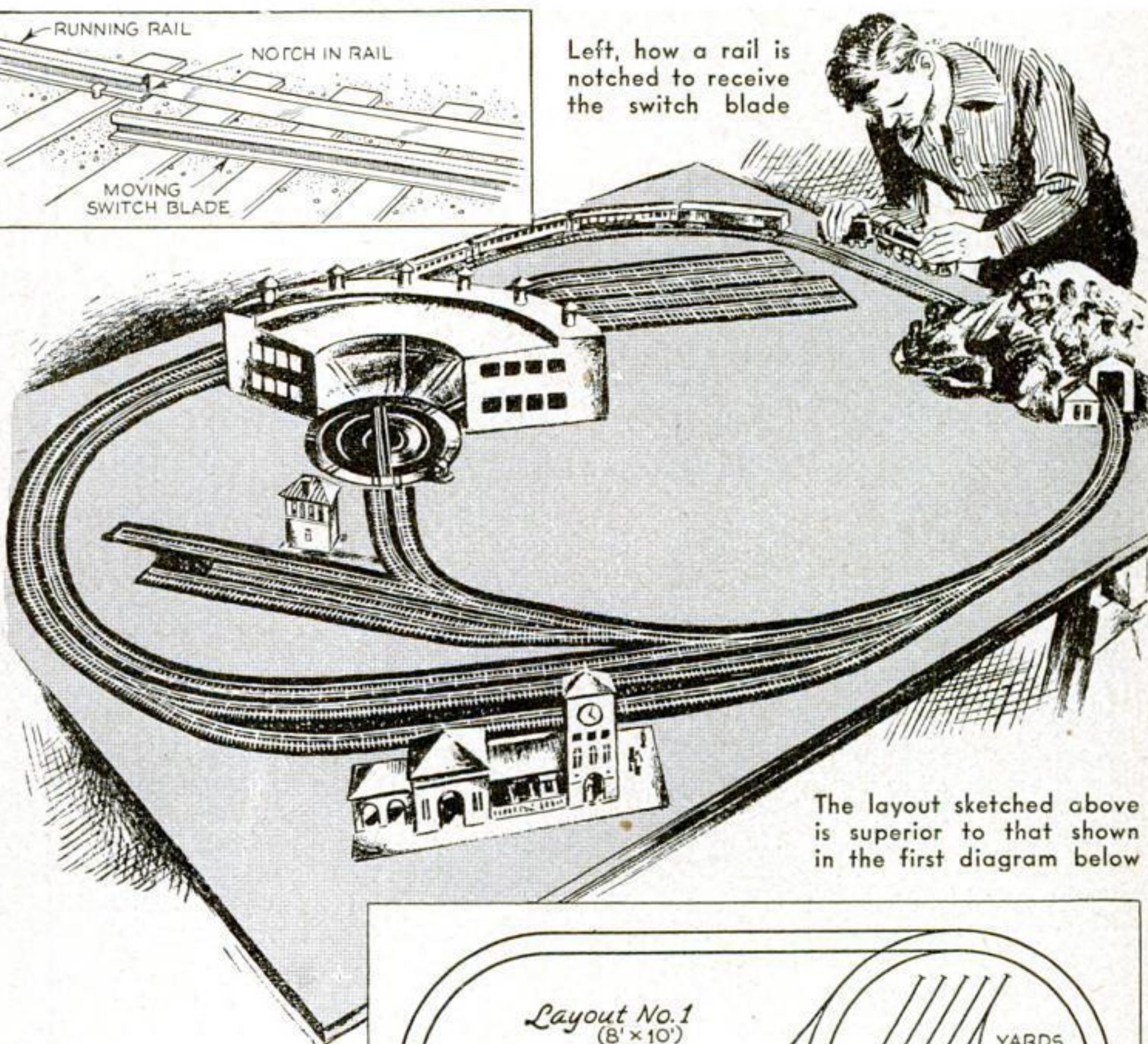
To build a switch, first make a full-size drawing on a big sheet of paper. The curvature of the rails should be of at least 2-ft. radius (preferably 3-ft.), so devise a compass from a strip of wood, or use a length of string, a pin, and a pencil.

When you have made the drawing, you can bend the parts to fit, then lay them down on the ties, checking them frequently with a track gauge. Specially wide tie strips are available for switches, and when the switch is complete, the excess lengths are cut off to match the radius of the curved rail. If you intend to make several switches of the same size, it is helpful to build a jig such as was described previously (P.S.M., Oct. '37, p. 137). Then the parts can be soldered to metal cross ties that will keep the parts in line.

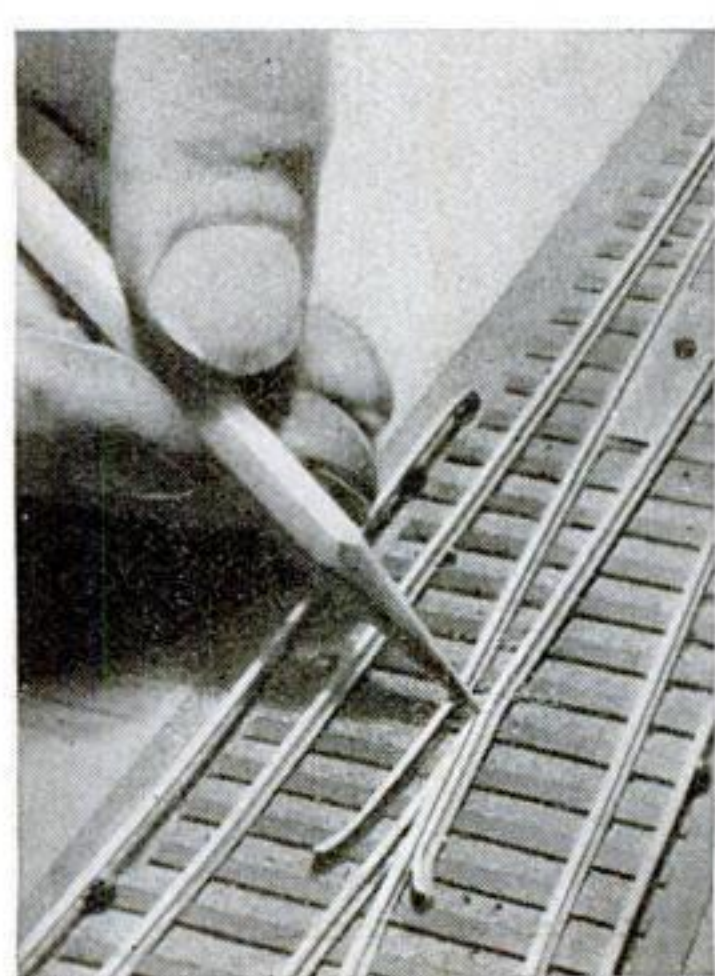
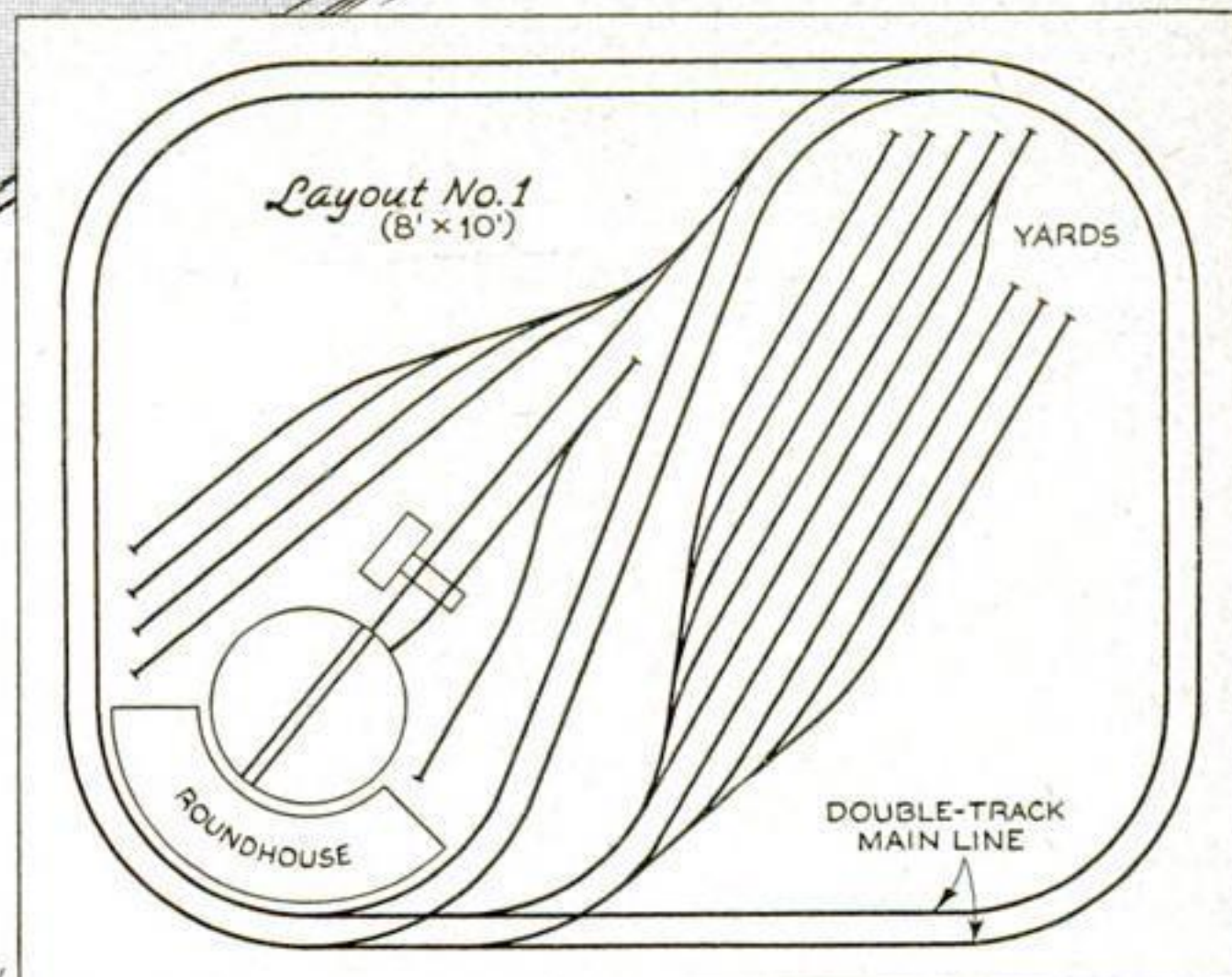
Note how the outer rails of the switch are notched to accommodate the points of the blades. This is important to assure smooth running. The two parts of the frog point are filed to shape, then soldered together. A hand lever can be used to throw the switch, or you can buy or make an electric switch (Continued on page 103)



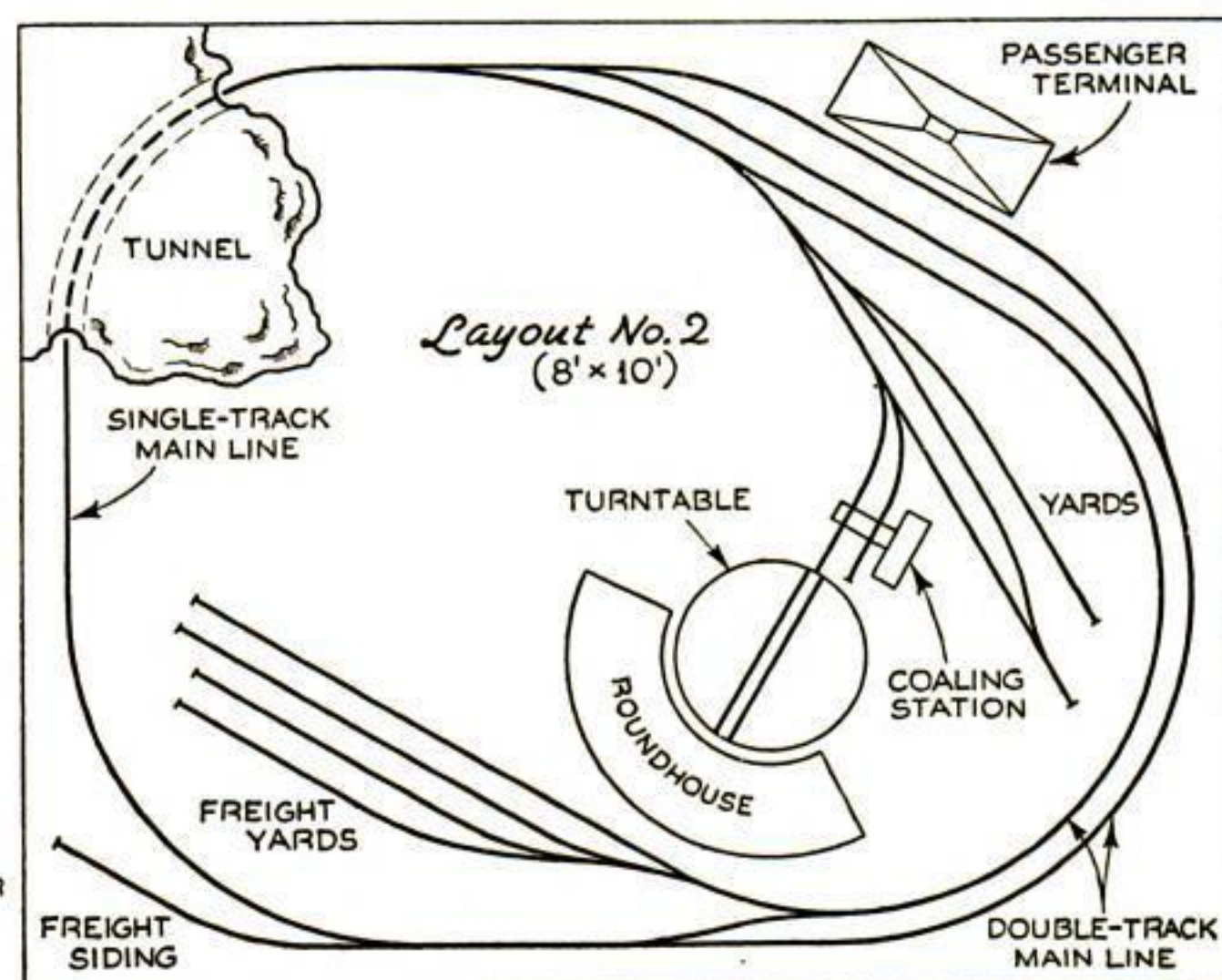
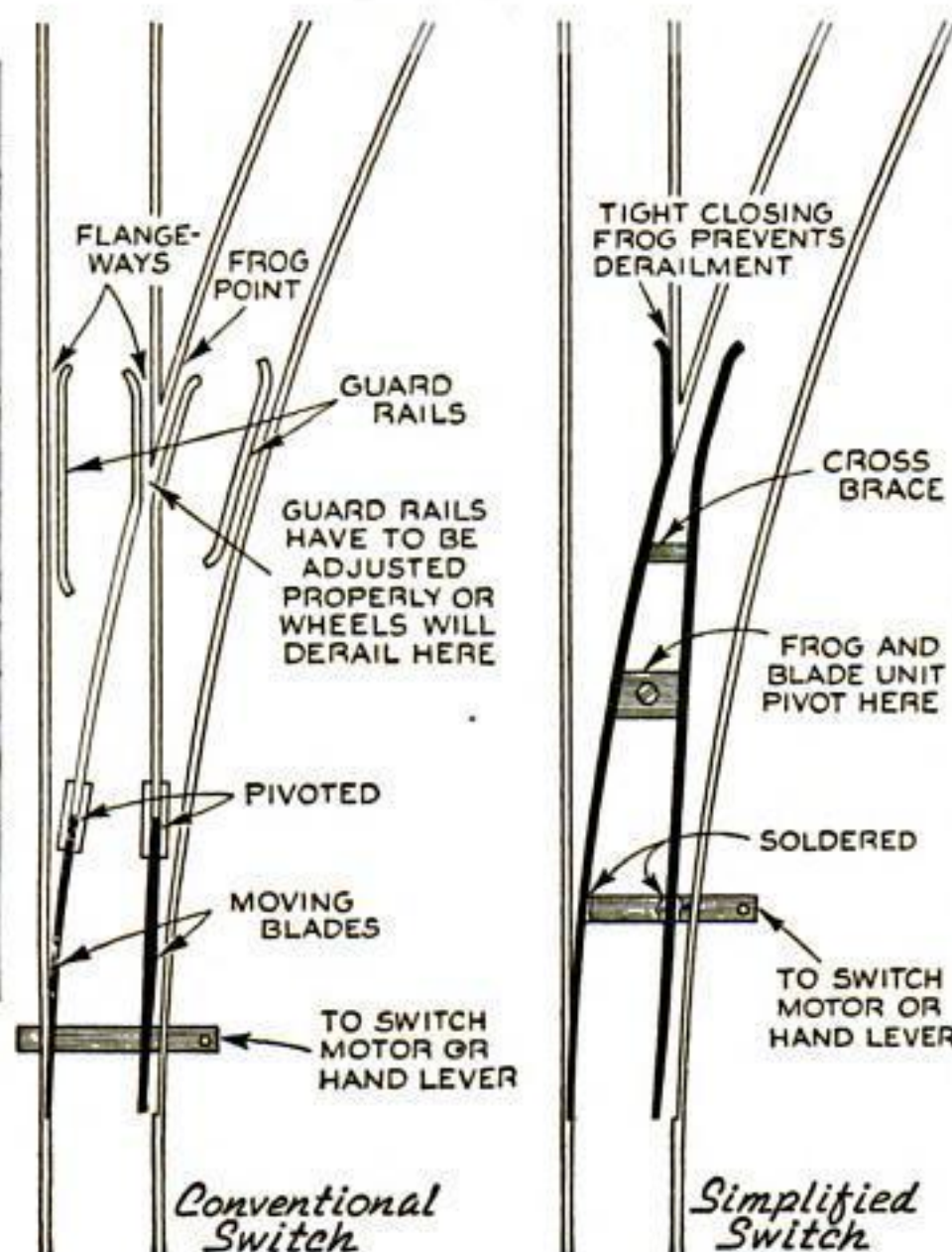
Left, how a rail is notched to receive the switch blade



The layout sketched above is superior to that shown in the first diagram below



The frog in a simplified type of switch. Guard rails are not needed to prevent derailment as in a conventional switch. Both types are illustrated at right



The first diagram above is a typical beginner's layout, while the second one is a much simpler and more practicable design



# Your Painting Questions

ANSWERED BY RALPH G. WARING

**F**OR many years Mr. Waring, who is a research chemist and specification engineer of national reputation in the paint and varnish field, has been answering technical questions. His regular articles in this magazine give information on those subjects he has found to be most troublesome to amateur painters, and this month he interrupts the series to answer seven questions of common interest about which readers have recently asked advice.

**Q** The living room and dining room of my home is what is called "sponge-finish texture." I understand that it was made by forcing a wet sponge against the soft plaster before it set and then smoothing the surface somewhat with a celluloid triangle. The walls have been painted with water paint several times. This is a troublesome and messy job, and I should prefer wall paper. Every workman who looks at the job has a different version of whether it is possible to paper over these walls or not. Some suggest replastering. What I want, of course, is a job that will last, at minimum expense.

**A** This stipple-coat plastering was a fairly expensive job, and it seems too bad to cover it up with paper. The



A starch coat protects painted wall finish

initial mistake was in the use of cold-water paint. Papering directly over the present coating would be unsatisfactory because of the multitude of small and large holes in the plaster. The paper would be punctured when the walls were dusted.

The most practical thing would be to scrub the walls free of calcimine with a fiber brush and hot water containing 1 qt. vinegar to a 12-qt. pail. When this is dry, have a competent decorator apply a coat of eggshell or semigloss wall paint, preferably of light ivory.

With this as a ground coat, let him stipple on a two- or three-color Tiffany glaze in very soft and subdued tones. Allow this to dry for a day or two, and brush on a starch coat made from regular lump laundry starch rubbed to a thin paste in cold water and then brought to a clear solution with boiling water, as for starching clothes.

Once or twice a year the starch can be washed off the walls with a sponge and warm water, taking with it all the dust, dirt, and soot from cooking. The wall coloring will remain for years or until redecorated to change the color scheme, provided, of course, the starch coat is renewed after each cleaning. (For instructions in regard to applying a Tiffany glaze, see P.S.M., Jan. '37, p. 72.)

**Q** To stain some plywood paneling, we mixed a stain from oil color, turpentine, and varnish. This was applied with a brush and wiped off with a rag. The color of the stain turned out much darker than we expected. Is there any way we can remove the stain entirely, or at least bleach it out?

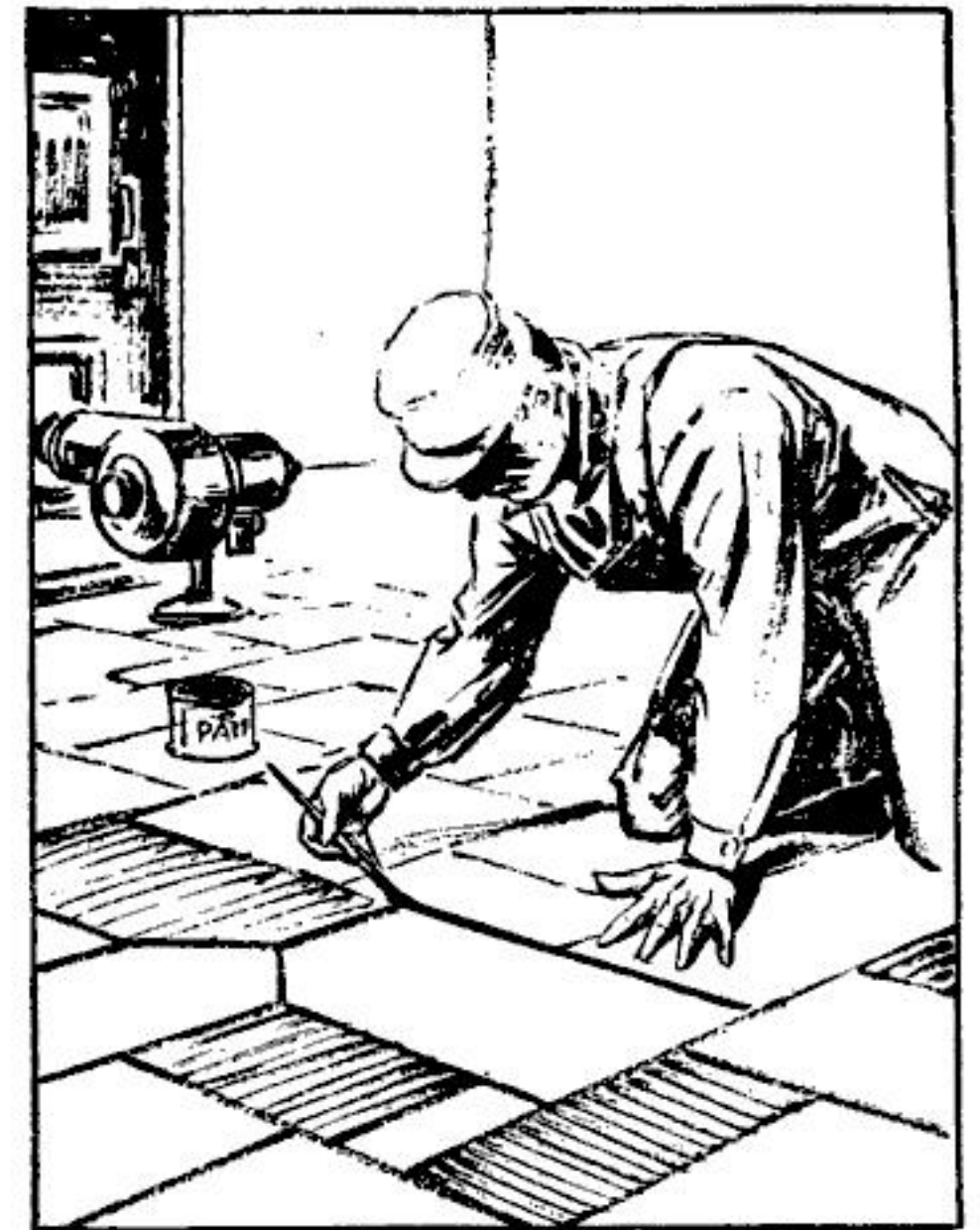
**A** The paneling can be cleaned up readily to any degree of lightness by sanding with an open-face 3/0 finishing paper lubricated with a mixture of two parts gasoline and one part pure turpentine. Use a felt block if available. If not, use several layers of hat felt glued on a wooden block of convenient size. Wipe clean with rags as the sanding progresses so as to ascertain the evenness of color value.

**Q** Can you tell me how to treat the floor of our basement playroom? A finish is required that will be attractive, yet will stand a lot of very hard wear.

**A** You will need a special type of paint made on a so-called "rubber" cement, waterproof base. Ordinary oil paints will react with the lime content



Cracks are cut to make them wider at back



Marking the "joints" of painted flagstones

of the cement and slowly change to soap, which becomes very soft and hence wears off easily.

Obtain a number of garden illustrations and study the designs of natural flag walks and terraces. Use gray, both light and dark, also brown and light brown toned off with green to imitate these stones on your floor, leaving about an inch space between each painted "stone." Let the entire floor dry and then use a 1-in. XXX black China bristle varnish brush to run a line of black or other color along the "joints." This method gives attractive results and because of its irregular coloring and arrangement will not show wear and tear for a long time.

**Q** As a painter, I have found when calcimining a ceiling that the calcimine runs in the summer time and looks like holes of a screen. Can you tell me the cause and remedy?

**A** Some types of casein-base calcimine are inclined to run and show pinholes in hot or warm and very humid weather. The remedy is to have all possible doors and windows open to create enough circulation of air so the freshly applied coating will set up rapidly. When the pinholing and running has occurred, sand the job clean and level, and recoat. If ordinary calcimine was used, wash off and apply a new coat as soon as the wall has dried properly.

**Q** We are planning to redecorate our living room and bedrooms. Several cracks and checks are quite noticeable in the plaster walls. How should these be taken care of?

**A** Use a well-sharpened knife to cut out along the cracks as at the left, leaving the underside nearest the lath wider than the top surface, like an inverted V. The patching plaster may be either the material sold under that trade name or plaster of Paris wet with a weak solution of glue water to keep it from (Continued on page 111)

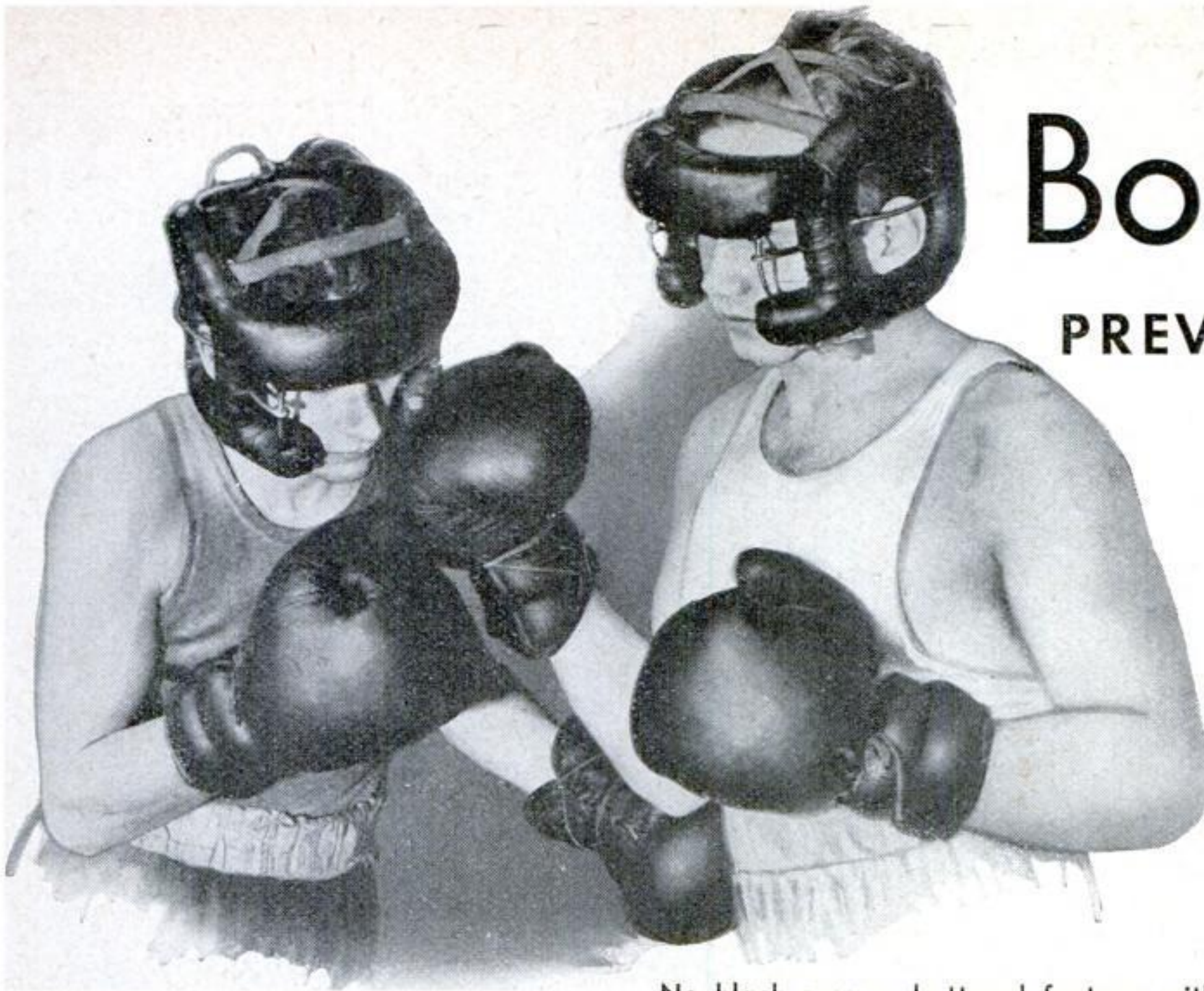


# NEW TYPE Boxing Mask

## PREVENTS HEAD INJURIES

By  
**Dr. Canute Hansen**

Director of Physical Education,  
College of the City of New York



No black eyes or battered features with these masks! They are of metal, very heavily padded

SO MANY young men have received serious injuries or been disfigured in amateur boxing bouts that the sport has been banned at a number of universities and other major educational institutions. The danger usually associated with the sport has also prevented this type of athletic activity from gaining any foothold in the high schools of the country. To overcome this serious drawback and restore collegiate and high-school boxing to the place it deserves to hold, I have designed a mask that entirely prevents face or head injuries.

Well-padded and of unusually strong construction, the mask gives most effective protection. This was demonstrated recently by striking a wearer with a large hammer and then standing on the mask while he lay on the floor. The masks are now in use at the College of the City of New York for competitive intramural boxing. Interest in boxing is increasing, and bans elsewhere will probably be lifted as a result. I have experimented with all types of masks and find that this design answers every requirement for beginners and for those in training.

The basic frame is cut from thin sheet metal—22-gauge half-hard steel or 20-gauge half-hard bronze is best, although

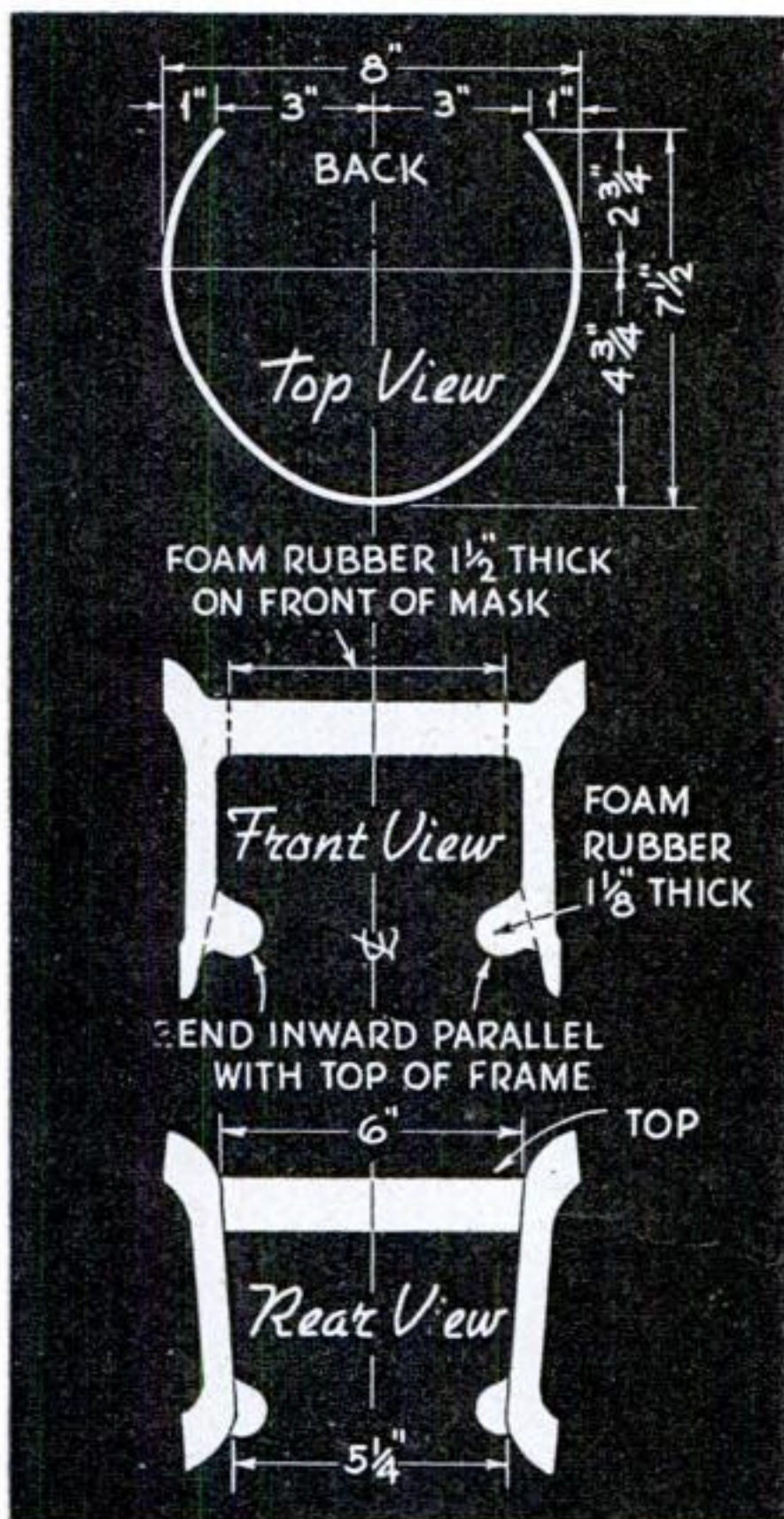
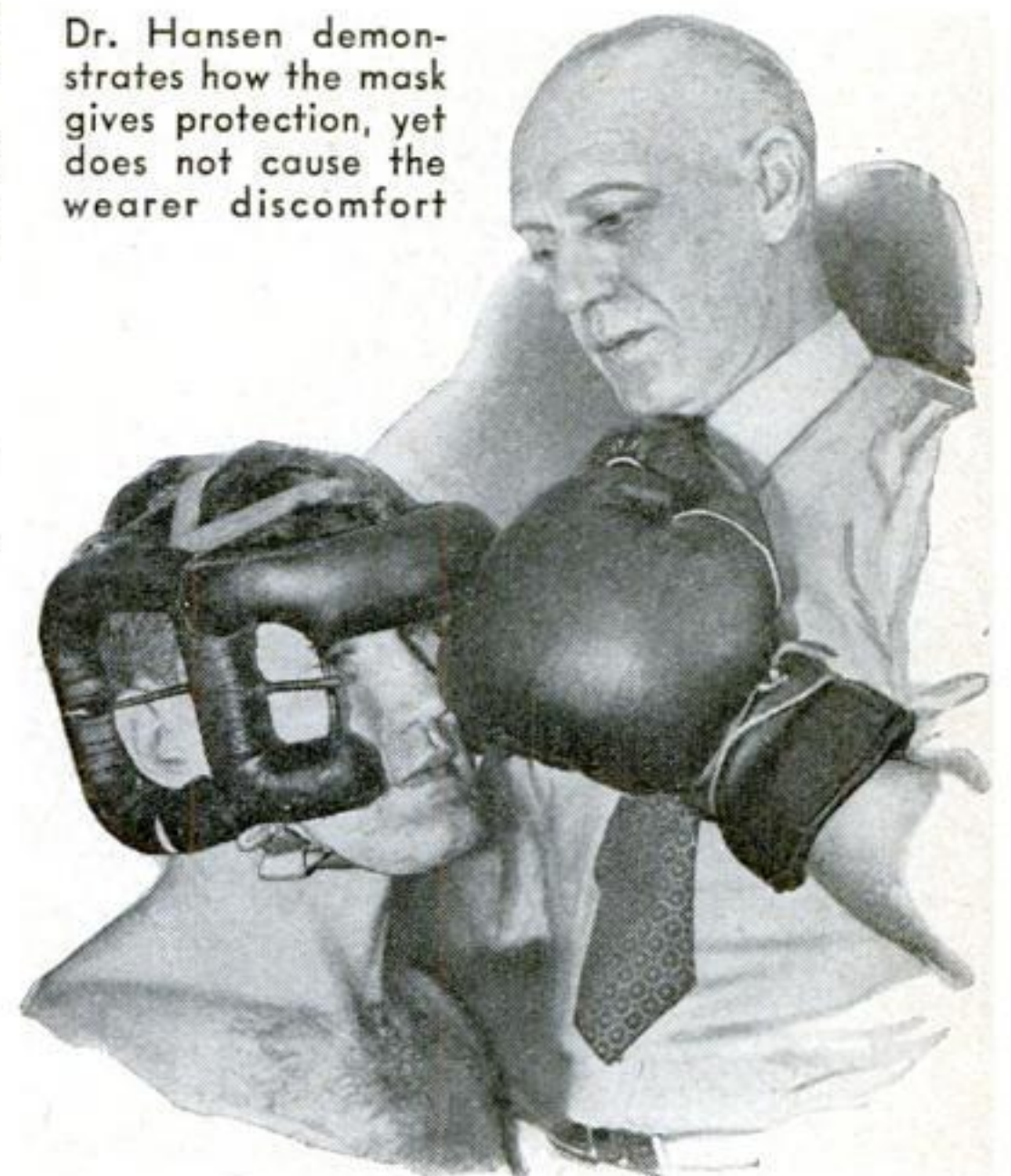
20-gauge copper may be used. Lay out the design full size on a piece  $6\frac{3}{4}$  by  $19\frac{3}{4}$  in., cut it out, and roughen both sides to hold the padding better.

To strengthen the framework and provide added protection, attach  $\frac{3}{16}$ -in. wire on the outside, as indicated in the drawing. If sheet steel is used, spot-weld tinned steel wire in place; for sheet bronze solder on phosphor-bronze wire. Make the strap loops by bending  $\frac{1}{8}$ -in. wire to form an opening  $\frac{3}{16}$  by  $1\frac{1}{16}$  in. and hold with a piece of sheet metal, which is spot welded (or soldered) to the frame.

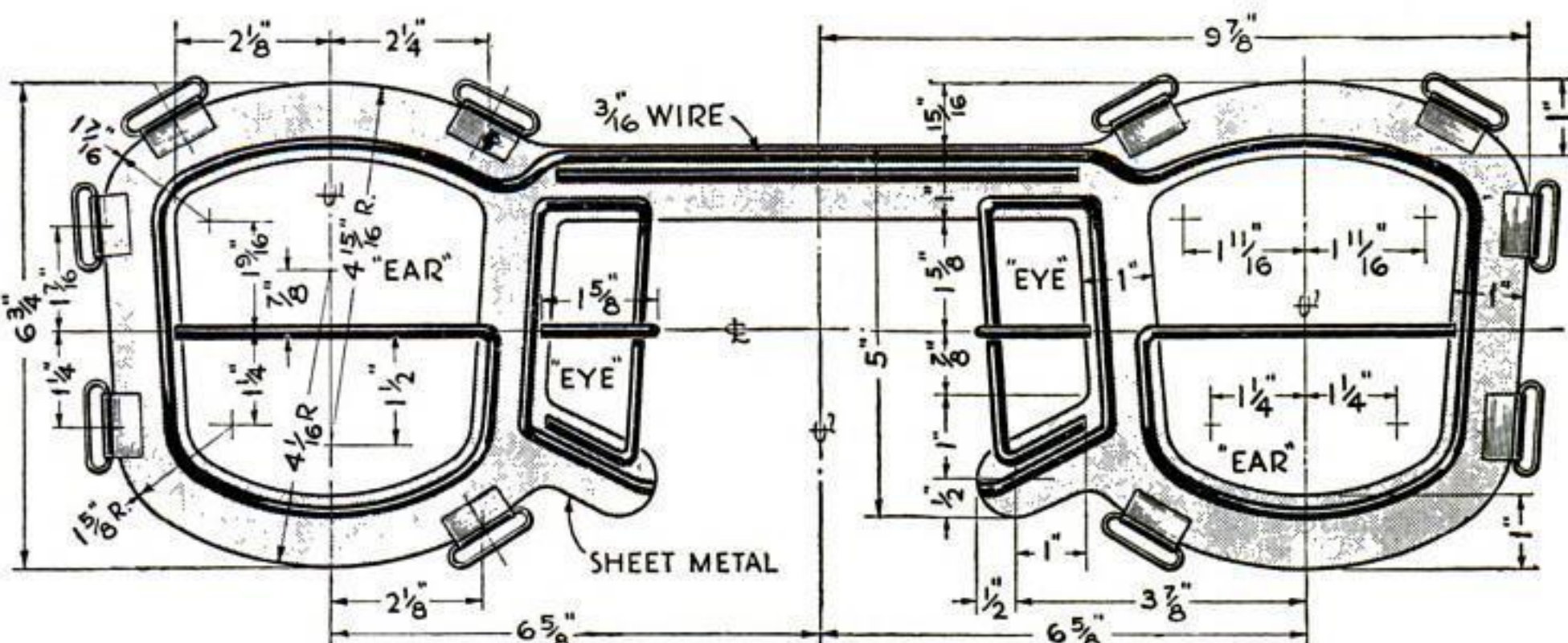
Cover the entire frame, after it has been bent to fit the head, with  $\frac{1}{8}$ - to  $\frac{1}{4}$ -in. sheet rubber (inner-tube rubber will do) except the cross-bracing of the "ear" and "eye." These are left bare as shown in the photographs. Next comes a layer (inside and out) of foam or sponge rubber  $\frac{3}{4}$  in. thick, except across the forehead, where it is  $1\frac{1}{2}$  in., and on the cheek extensions, where it is  $1\frac{1}{8}$  in. Foam rubber is lighter than sponge rubber and has a finer texture, but is not as easy to obtain. Bind the rubber with adhesive tape 1 in. wide, and cover with a thin, smooth, water-repellent black leather, which is sewed in place. Be careful not to cover the strap loops.

The chin strap is 1-in. elastic webbing with a slide clasp, and the head straps are  $\frac{5}{8}$ -in. strap webbing with a spring buckle. You can, of course, use any suitable straps that are at hand.

Dr. Hansen demonstrates how the mask gives protection, yet does not cause the wearer discomfort



How the metal frame is bent and covered

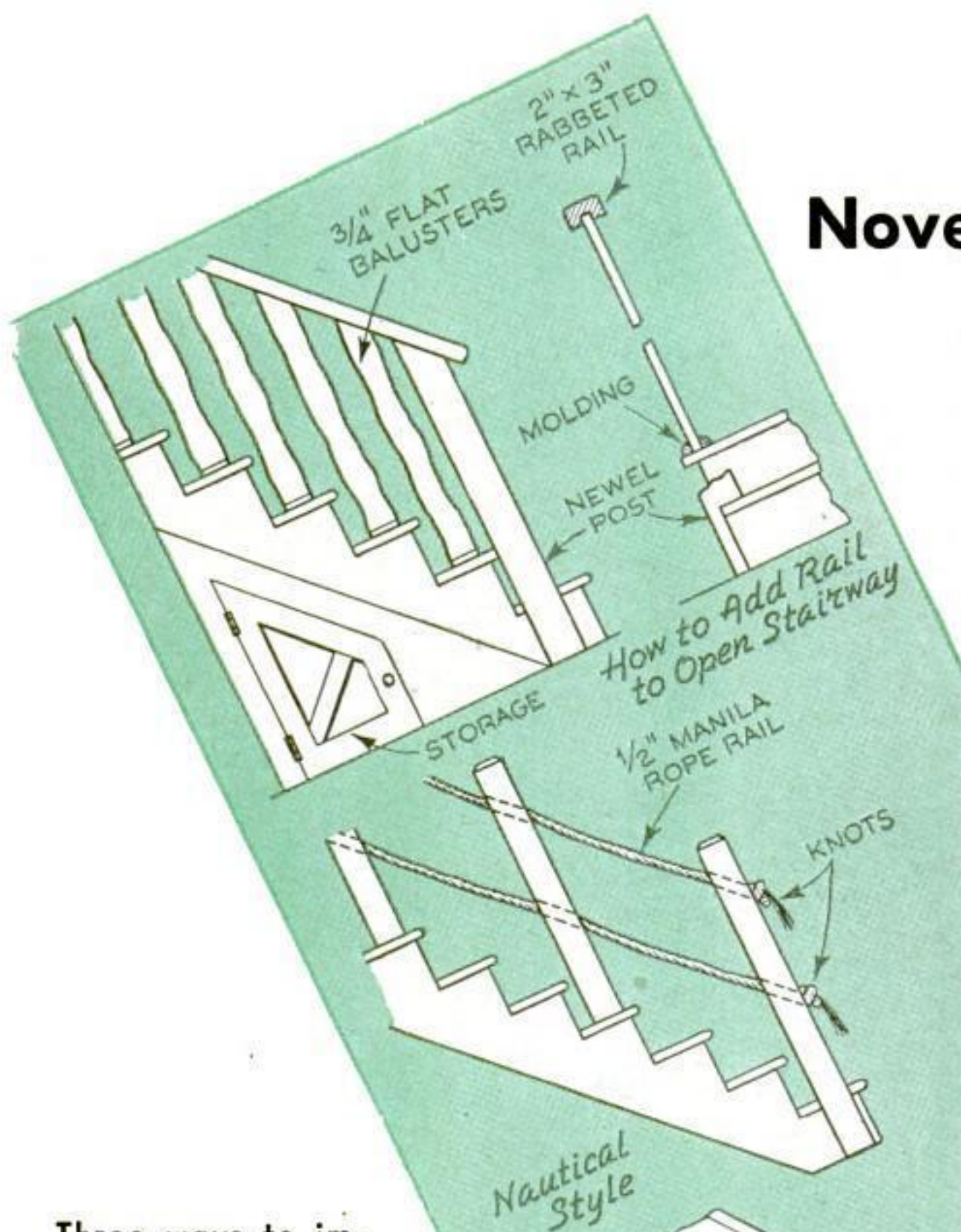


The framework of the mask before it is bent to the shape indicated by the three diagrams above. The wire used for reinforcement is spot-welded or soldered on the outer surface



# Dressing Up a

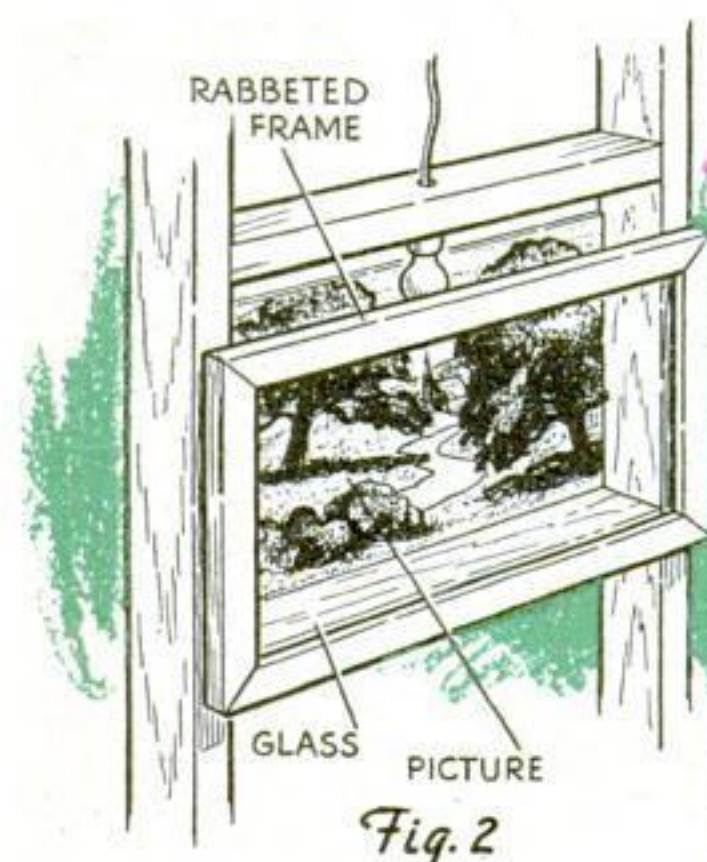
Novel stairway treatments, scenic windows,



Three ways to improve the stairway. Adding a handrail is often sufficient. Rope may be used if the room is treated like a ship's cabin



Looking across the game room of Arthur Ferber, Madison, N. J., to the stairway. The woodwork is of pecky cypress



A softly illuminated landscape or seascape behind a glass frame gives the effect of an outside window



By  
HI SIBLEY

WHEN the flooring has been nailed and the last wall panel set in place for your basement recreation room (see P.S.M., Mar. '38, p. 84), the next step is to change the cellar stairway so it is less of an eyesore. Several interesting treatments are possible.

For an exposed or partially exposed stairway, a handrail is easily built as suggested at the top of Fig. 1. Flat, upright members are the simplest to make and install, as they can be set in a rabbet in the underside of the handrail, and be held at the bottom between two strips of molding. The space underneath is fitted with a door or drawers, for storage. A rope rail is sometimes effective, especially where a nautical motif is carried out. If, however, the arrangement of your steps suggests a boxed-in stairway, that is probably the easiest type of all to build.

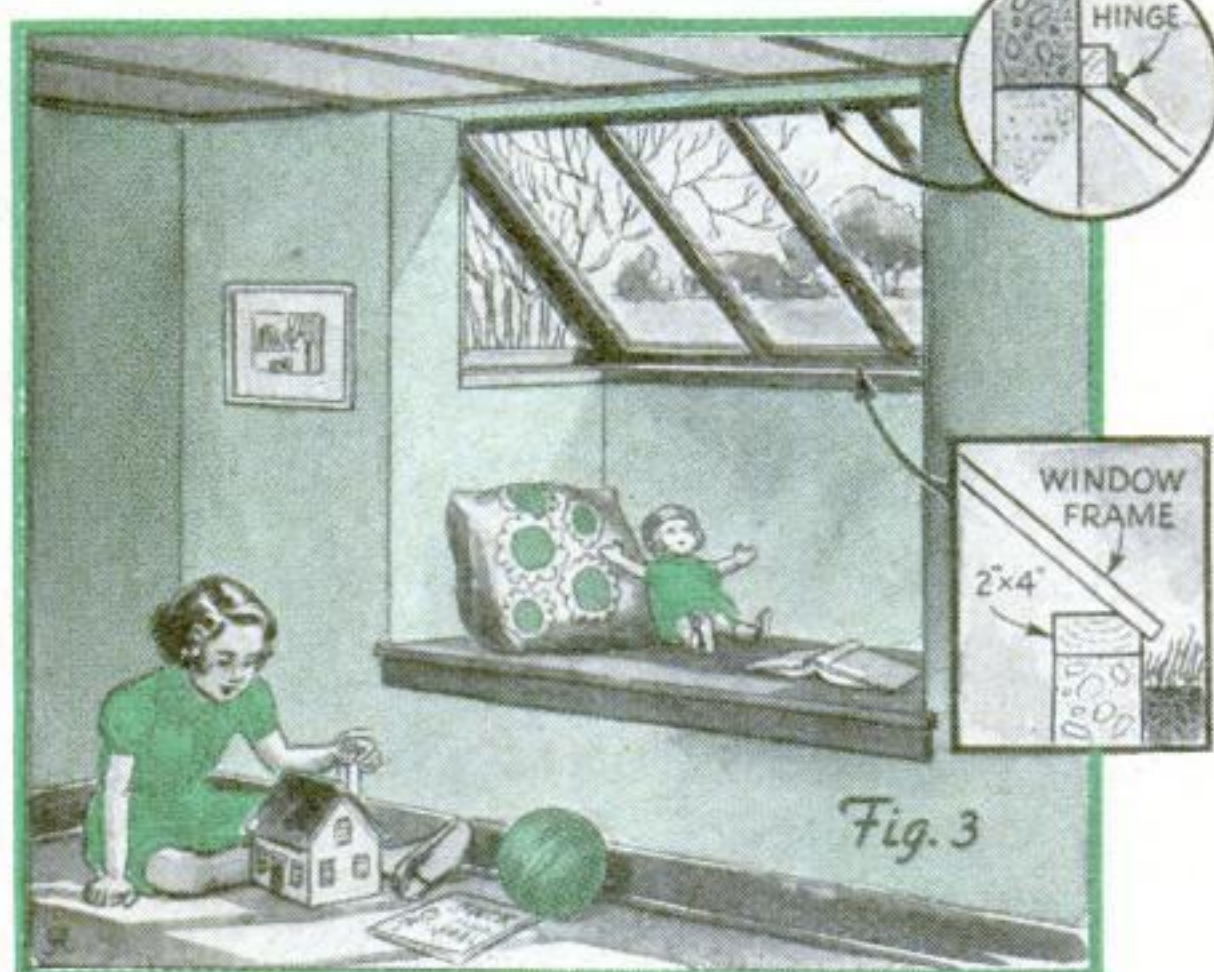
Wiring should present no difficulties. The installation of ceiling lights was described in a previous article (see

P.S.M., Aug. '37, p. 92). In case the basement has no outside windows or you wish to balance existing windows with others on the opposite side of the room, make illuminated frames as in Fig. 2 and put colored seascapes or pastoral scenes behind, using a not-too-bright bulb. These always add a cheery note and, if properly selected, lend the impression of looking out-of-doors. If the room is to carry out the idea of a yacht interior, make circular portholes instead of rectangular frames. Bear in mind that all wiring must be installed according to the National Electric Code and be properly inspected.

Get as much sunlight as possible into your basement in order to make it cheery during the daytime. See whether the grade near existing windows can be lowered so the openings can be made deeper. If this is not practical, you may prefer some type of bay window. One scheme, shown in Fig. 3, is to build, level with the ground, a bay window that has a slanting roof of glass. The sill can slope back towards the floor, or a seat or shelf can be built in. If you have large windows, it is best to arrange for heavy drapes, which help keep the cold out during the winter.

Refreshment bars are made in so many designs you had best select whatever kind appeals to you most, and Fig. 4 is merely a suggestion. This has the advantage, however, that it takes up very little space in the recreation room, most of it occupying part of the adjoining room. One home shown in a photograph has a bar that can be closed entirely with folding plywood doors.

Fireplaces present a problem for the basements of houses already built, but a dummy gas fireplace can be made as

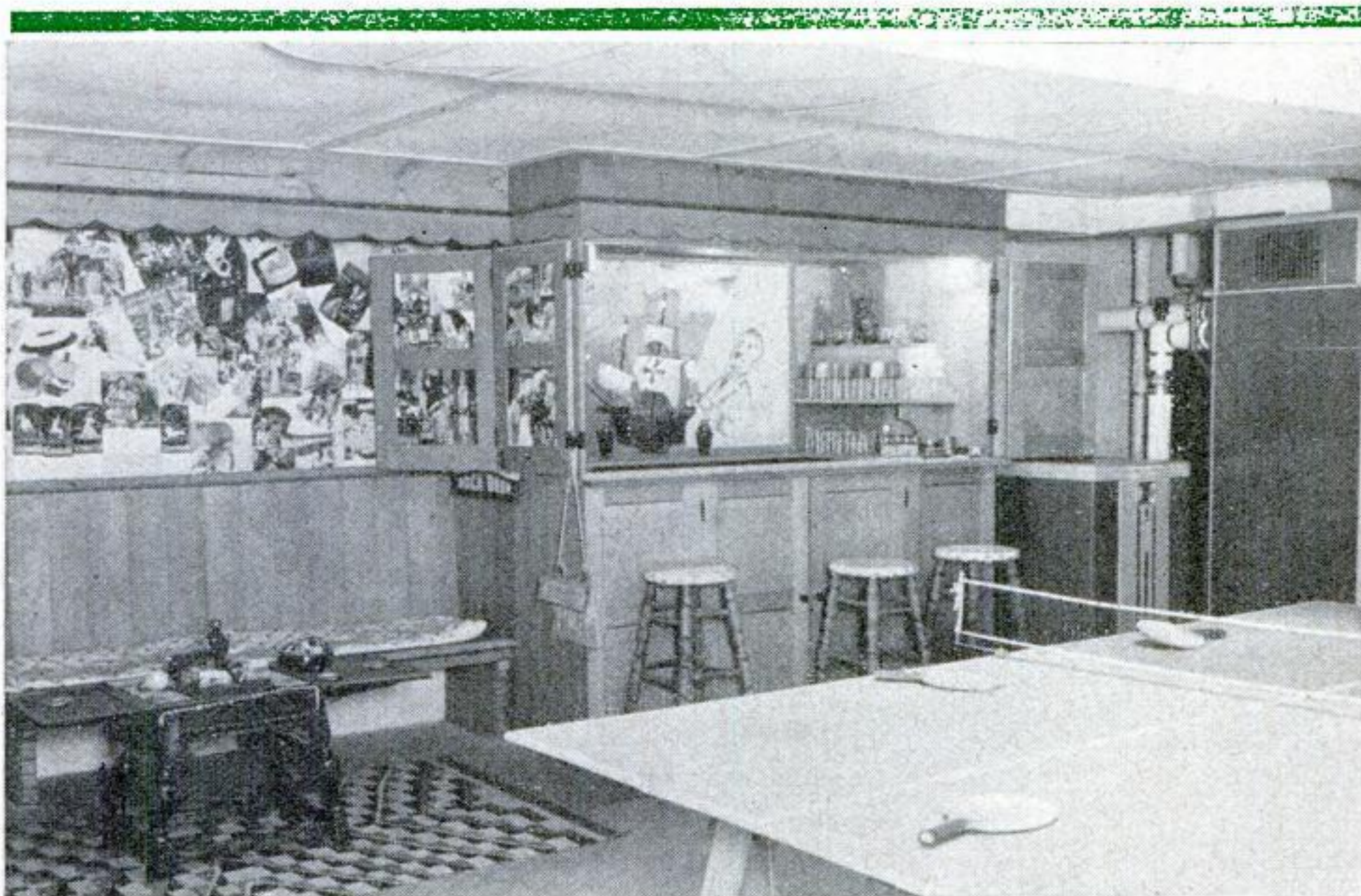


The lack of sunlight may be overcome by building a small bay with a slanting window and side lights

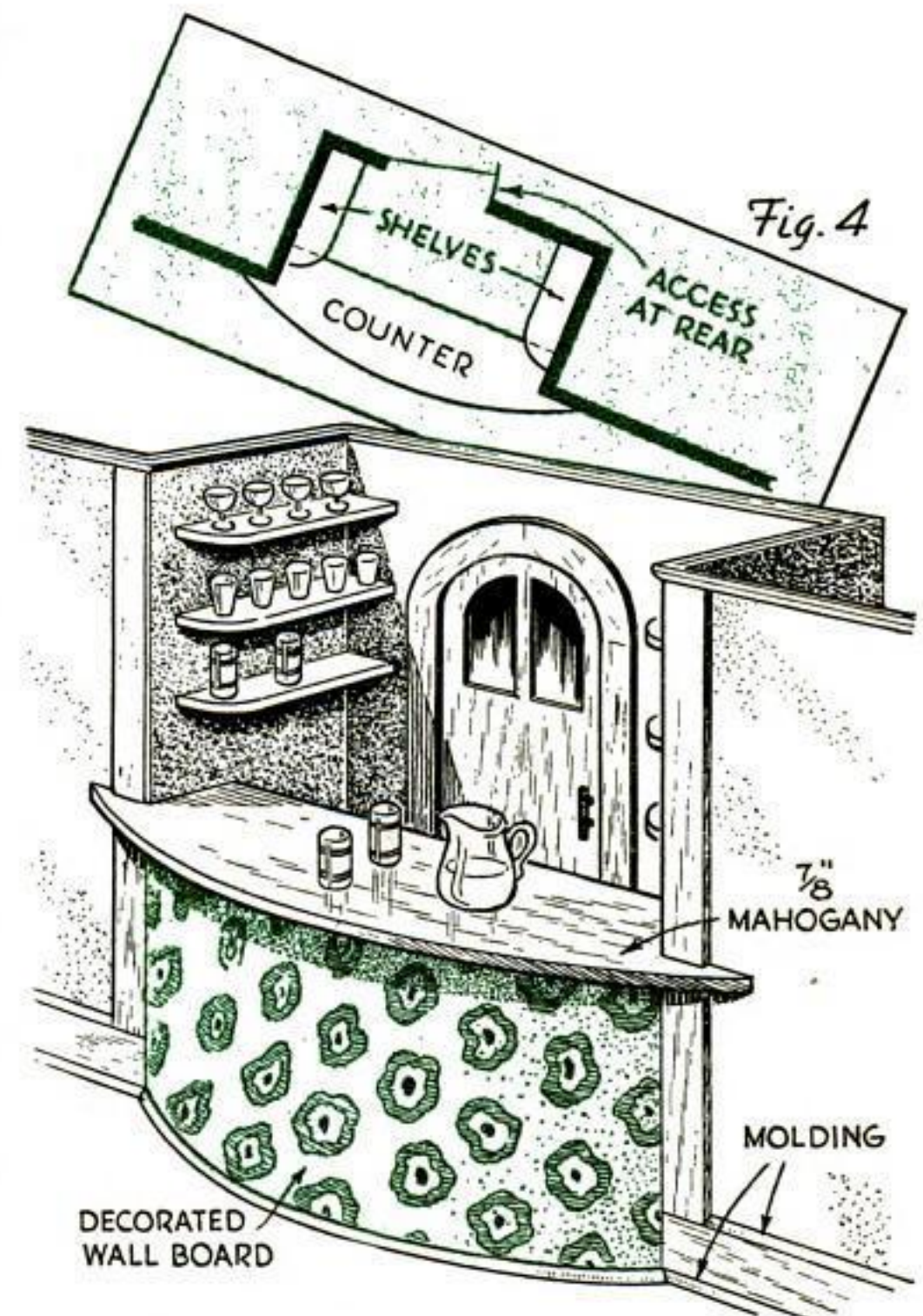


# RECREATION ROOM

fireplaces, built-in fittings, refreshment bars, and other ideas



Game room of Prentiss Fulmer, Altadena, Calif. The refreshment bar is built of plywood panels and has folding doors. The walls are Oregon pine, the valance of knotty pine



in Fig. 5. This requires an ample vent and should have a sheet-metal hood to direct the fumes toward the vent. The framework, however, is simply constructed as illustrated in the perspective drawing, and covered with your selection of pressed composition wood, wall board, or plywood. Shelves and a cabinet can be arranged on one side, a reading seat on the other.

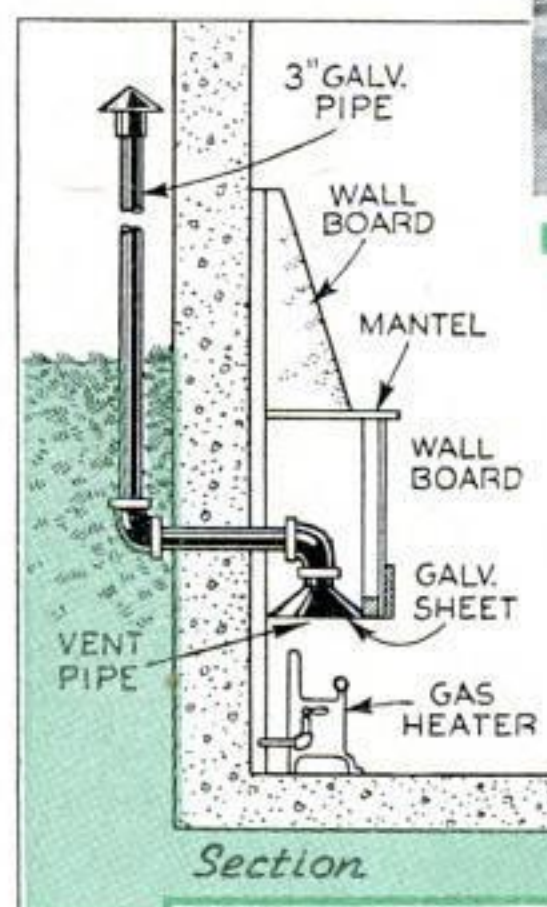
An electric fireplace is even simpler to build, as illustrated in Fig. 6, since it requires no vent. Plywood or composition board is used to good advantage here, and the space between studs on both sides is left unpaneled and fitted with shelves. These particular studs should be of surfaced material. The shelves are set in rabbets, and a molding is put over the front edges. This type of fireplace has the advantage of being very shallow and taking up little space.

Nothing is more inviting, of course, than the old reliable wood-burning fireplace, but this means considerable expense and is not easy to install, unless built with the foundations. However, if you insist on such a fireplace, some help is offered in Fig. 7. The important feature of any fireplace is ample draft, and to this end use large tile for the flue. If impracticable to carry it up through one side of the fireplace above (which would have to be partially torn down for the purpose), run it through the wall and up the side of the house, brick-ing around it, or better, breaking through the original chimney to one of the flues. Be sure to consult the regulations in your local building code because a chimney is always a potential fire hazard.

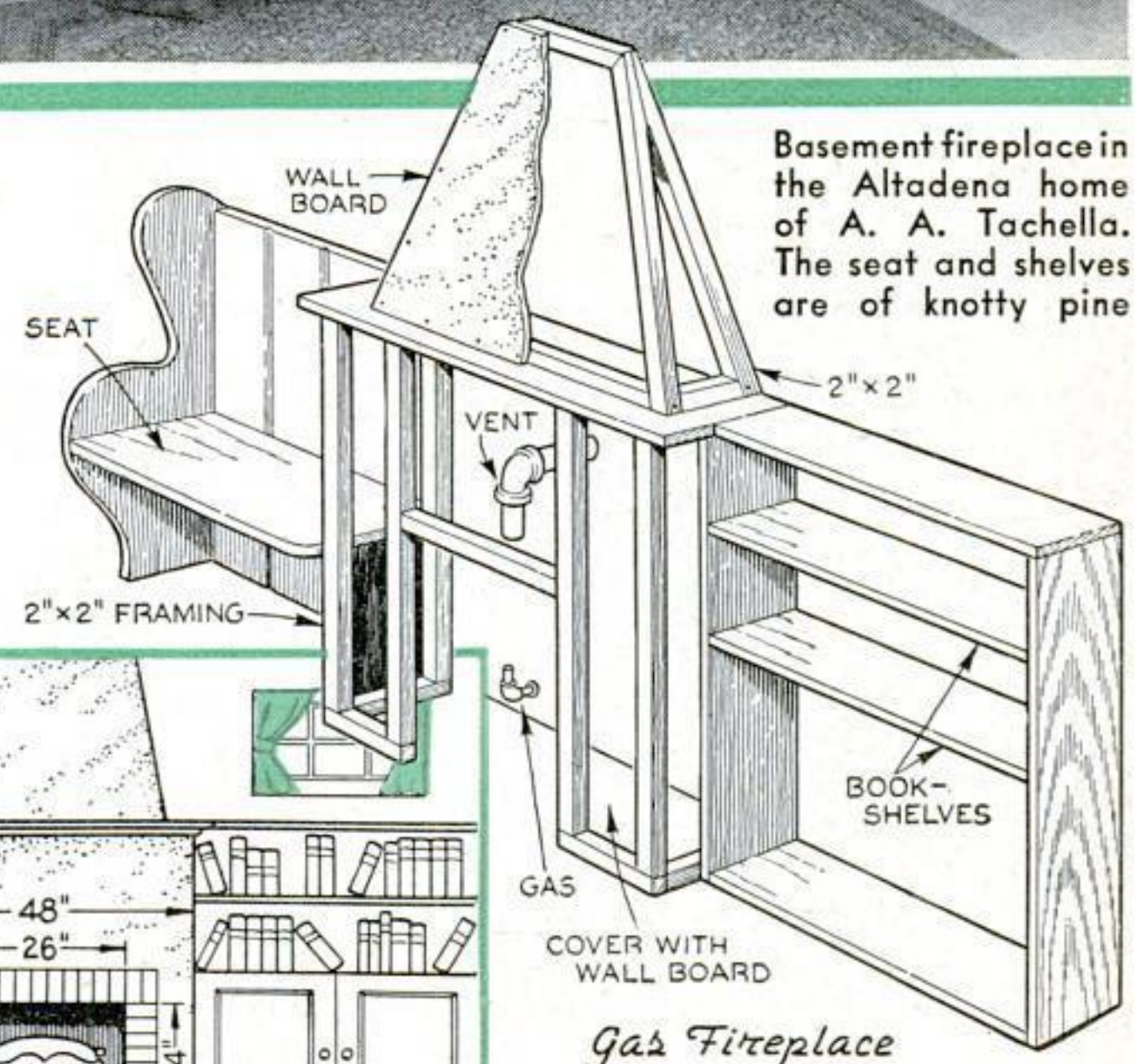
In finishing the ceiling, should the pipes be advantageously located, it would be possible to box them in and locate one or two other dummy boxes to give the effect of beams, as in Fig. 8. The same method may be used when necessary to conceal unsightly bridging or cross bracing between the floor joists. Hot-air ducts *(Continued on page 110)*



Basement fireplace in the Altadena home of A. A. Tachella. The seat and shelves are of knotty pine

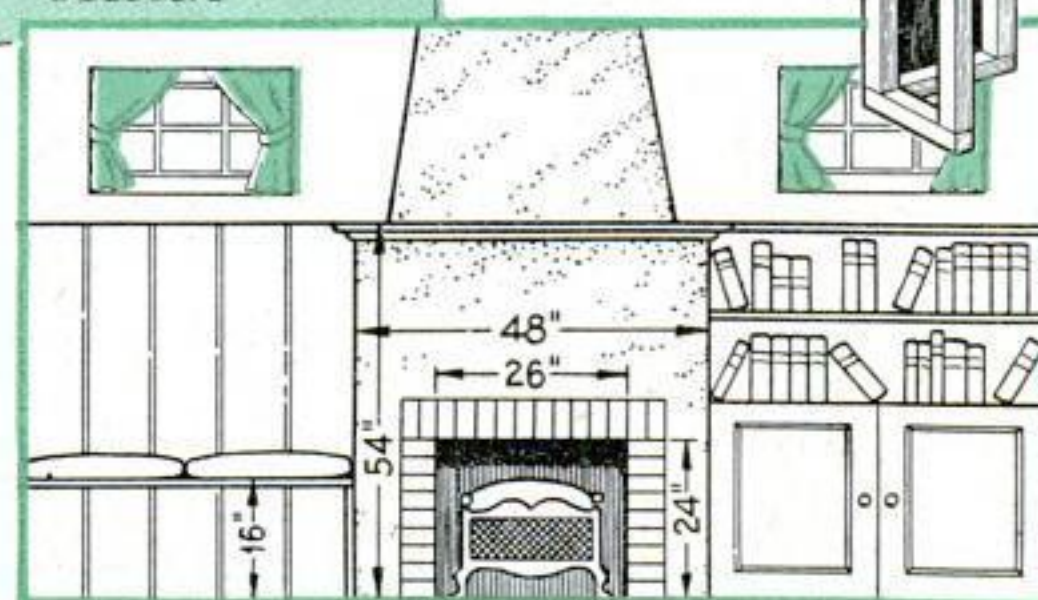


Section



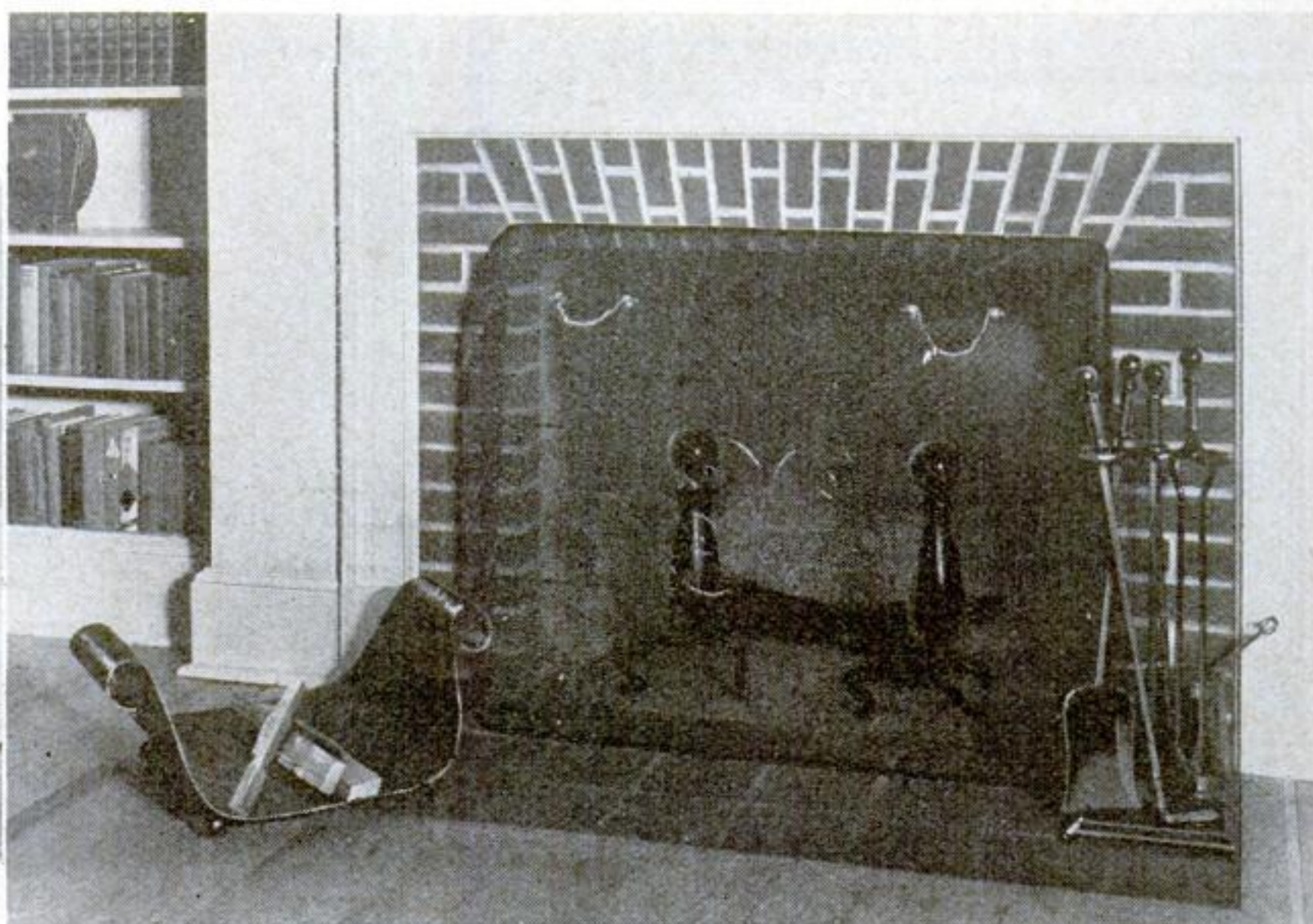
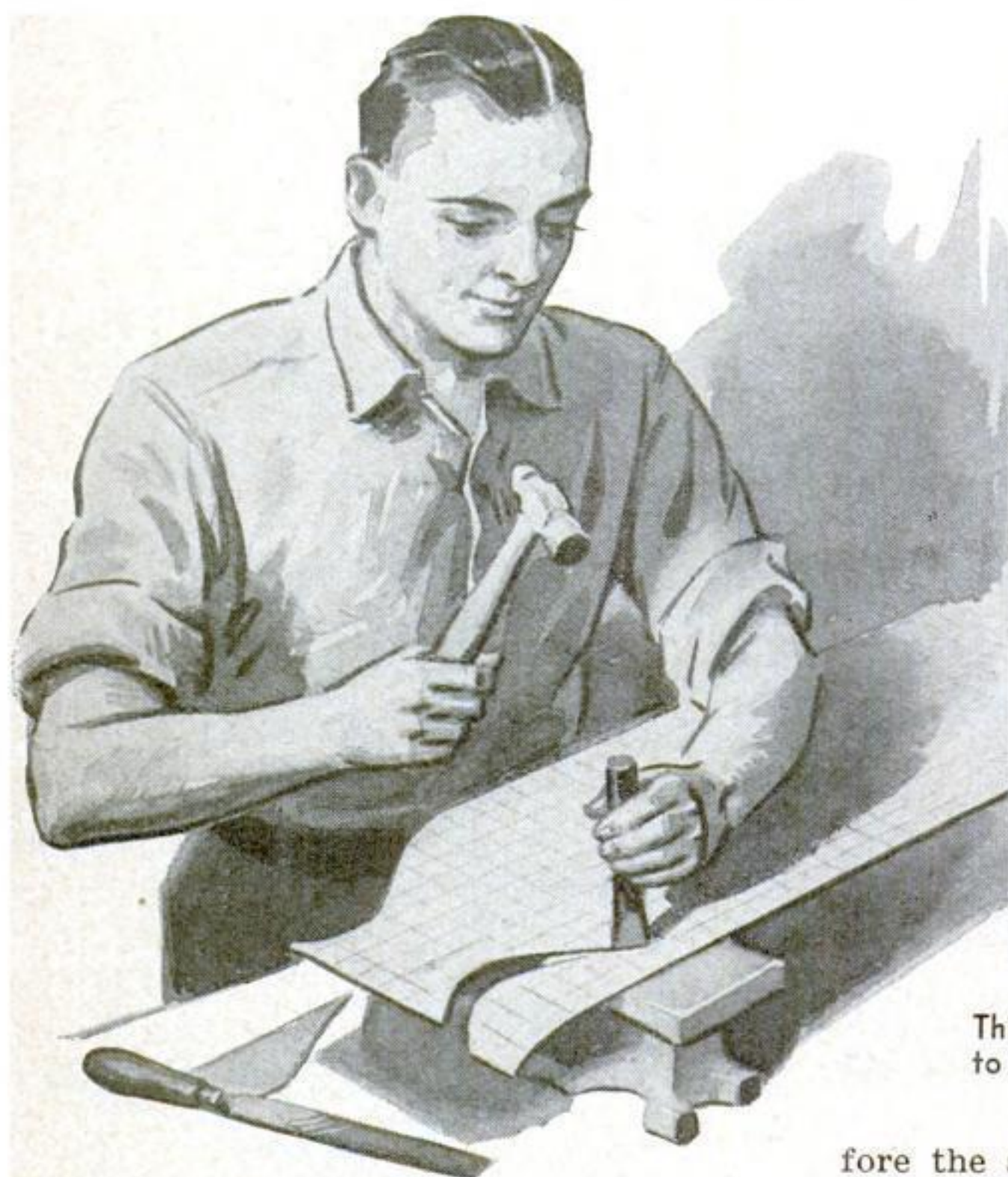
Gas Fireplace

Fig. 5

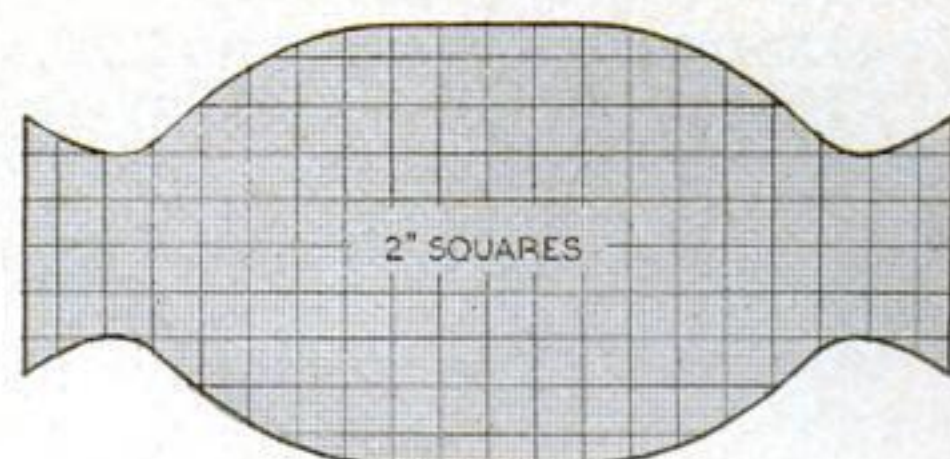




# Fireplace Wood Holder Cut and Bent from a Single Sheet of Metal



This piece is an attractive addition to any fireplace. Right, the pattern



**E**VERY fireplace needs a wood "basket." The one illustrated holds an abundance of wood and is simply and sturdily made of soft iron sheeting.

All one needs to make one like it is a rectangular piece of soft metal about 20 by 40 in. Its thickness can range from 1/16 to 3/32 in. After transferring the design full size to the sheet, cut along the outline with cold chisel and hammer. Dress the edges smooth with a file. The stippled effect is obtained by beating the metal with a ball-peen hammer be-

fore the sheet is bent into final form.

The scroll handles are made by bending each end around a 2 1/4-in. pipe. A more expert job may be done if the sheet is heated with a blowtorch before bending. The two body bends also can be hammered over the same pipe, using heat as before. The length from foot to foot is approximately 12 in.; from inside the top, scroll to scroll, 15 in. The feet consist of four 2-in. round wooden knobs mounted with countersunk screws through the sheeting.

The whole is finished in glossy black enamel over a coating of metallic primer.

If suitable soft iron sheeting is difficult to obtain or found somewhat hard to work, an excellent substitute is a piece of sheet metal obtained from a wrecked car door and welded together to the proper size. If brass is available, hammer and polish to a natural finish without painting.—C. H.

## Tin-Can Tool for Transplanting Seedlings

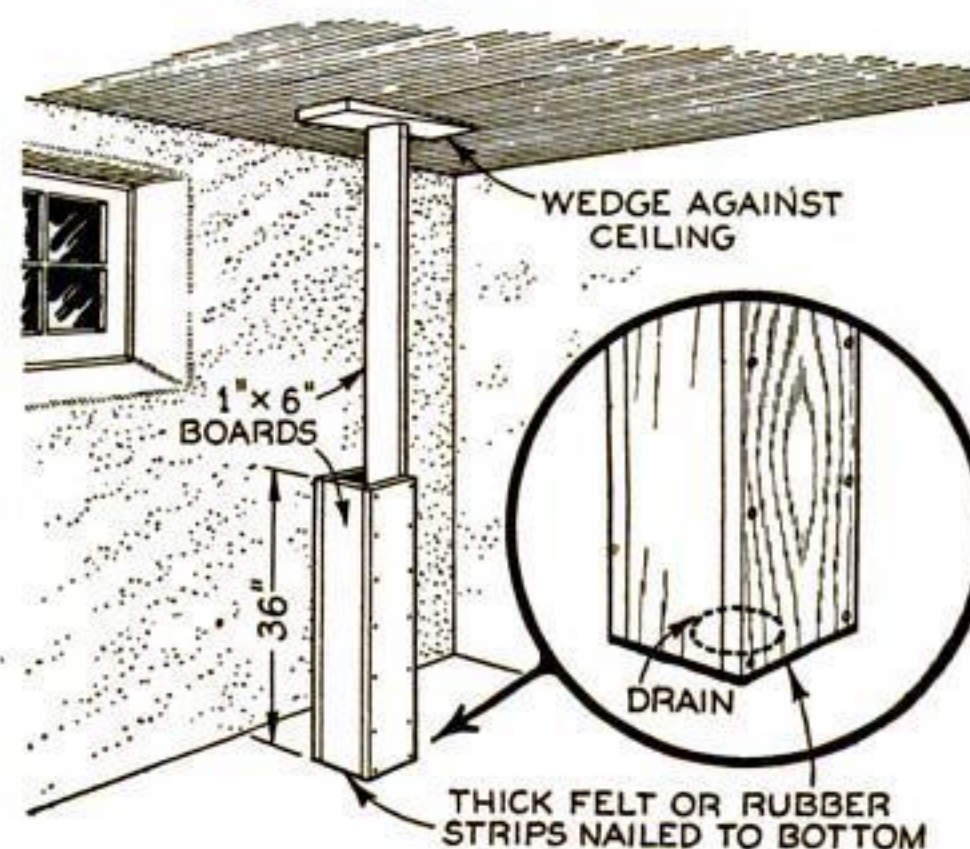
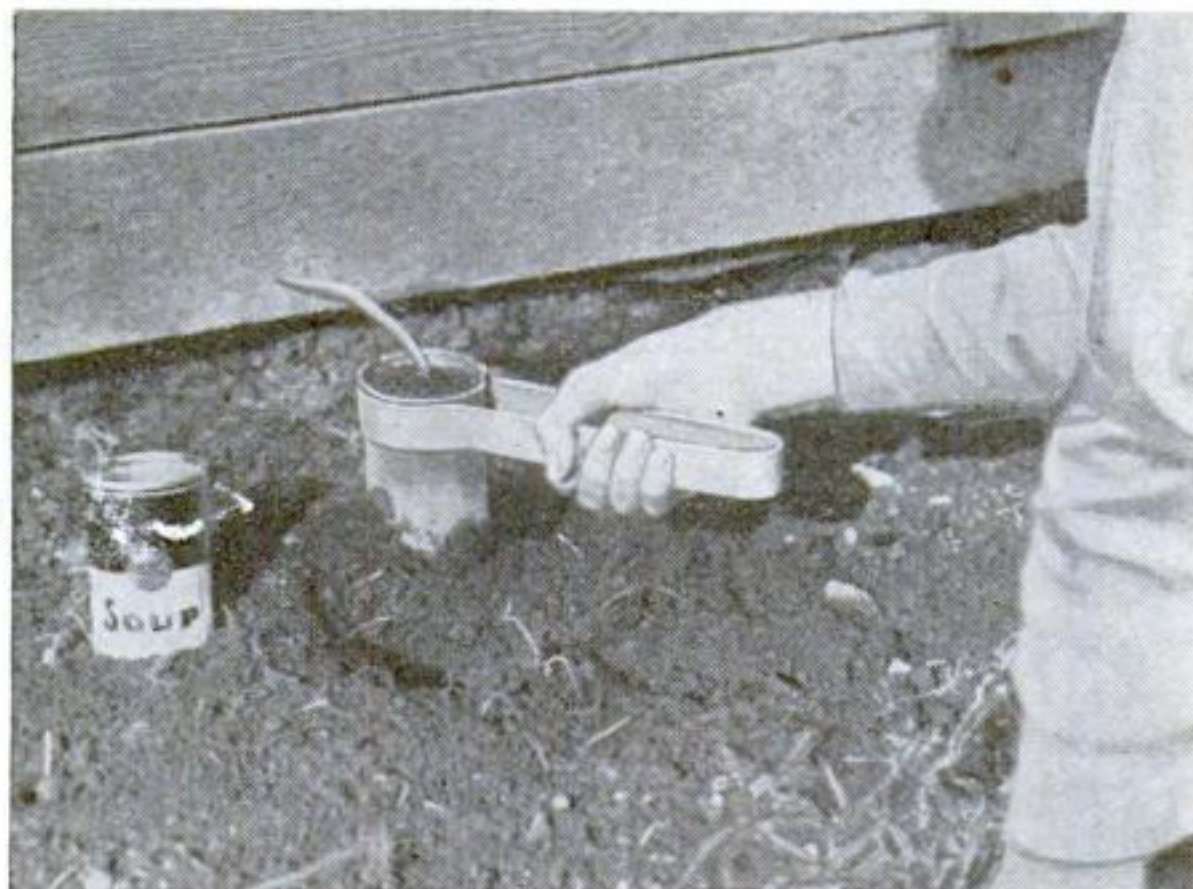
**F**OR transplanting purposes in the garden, a handy tool may be made as shown below. A handle of 1-in. band iron is bent and riveted to a small tin can, from which both ends have been removed. Jagged teeth are then cut in the lower end, and the can is also cut lengthwise into halves. These are sep-

arated a little by bending the handle.

To use, press the can into the soil, squeeze the handle, and lift out the dirt where the seedling plant is to be set out. Place the tool over the seedling, lift it out with the surrounding soil, deposit it in the hole first made, and press down the soil.—CHARLES M. RICE.



The can is first riveted to the handle, then cut as shown with tin snips. It is worked like a pair of tongs, as at the right



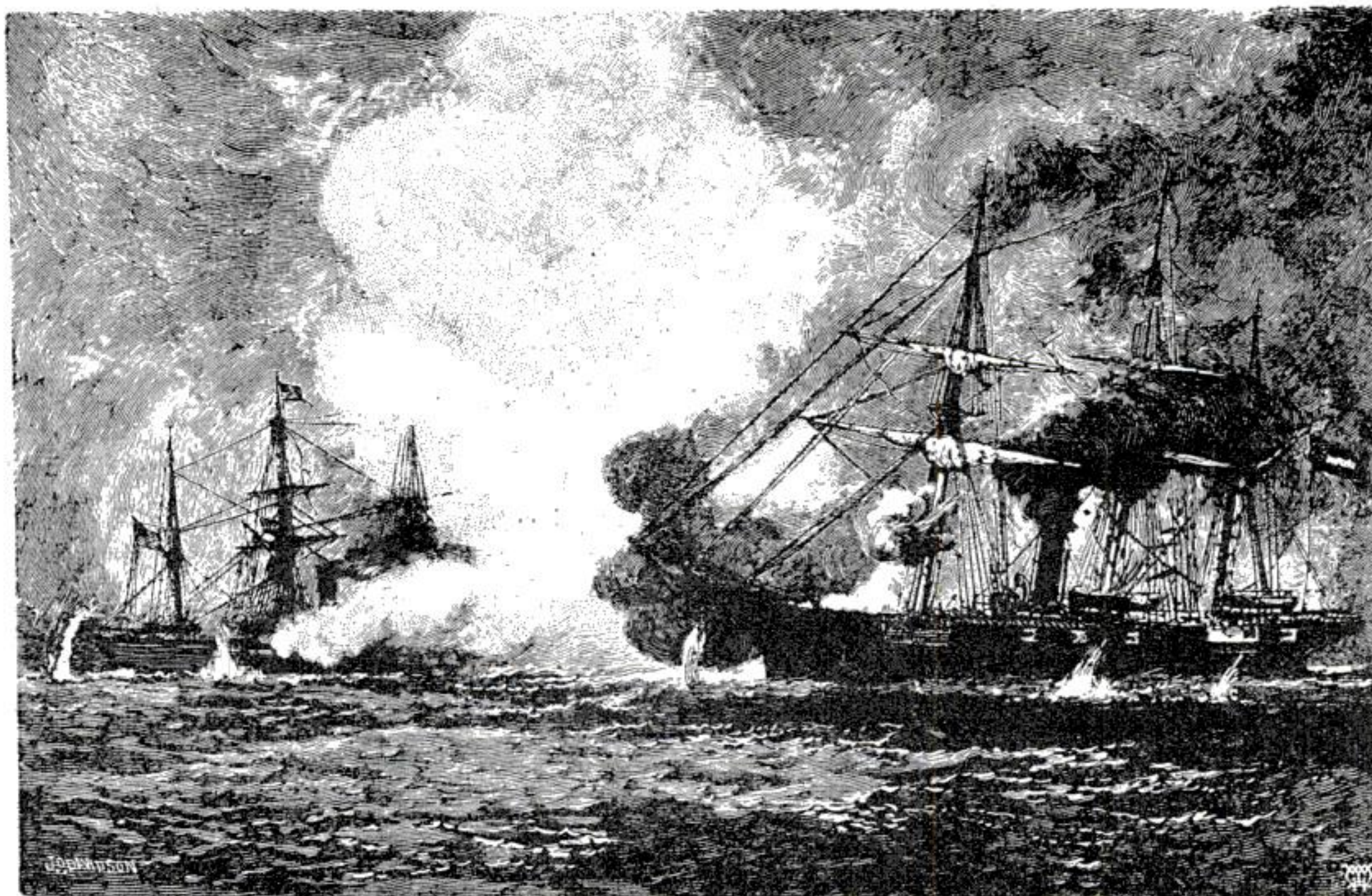
## Keeping Basement Dry in a Flooded Area

**I**N ANY locality subject to floods, water can be prevented from rising in the cellar through the basement drain by making a wooden chute of 1 by 6-in. boards as shown above. Paint the edges heavily before nailing the pieces together, and nail felt or rubber strips to the bottom edges. When a flood is in prospect, the chute is set in place and wedged securely.—A. E. O.



By CAPT.  
E. ARMITAGE  
McCANN

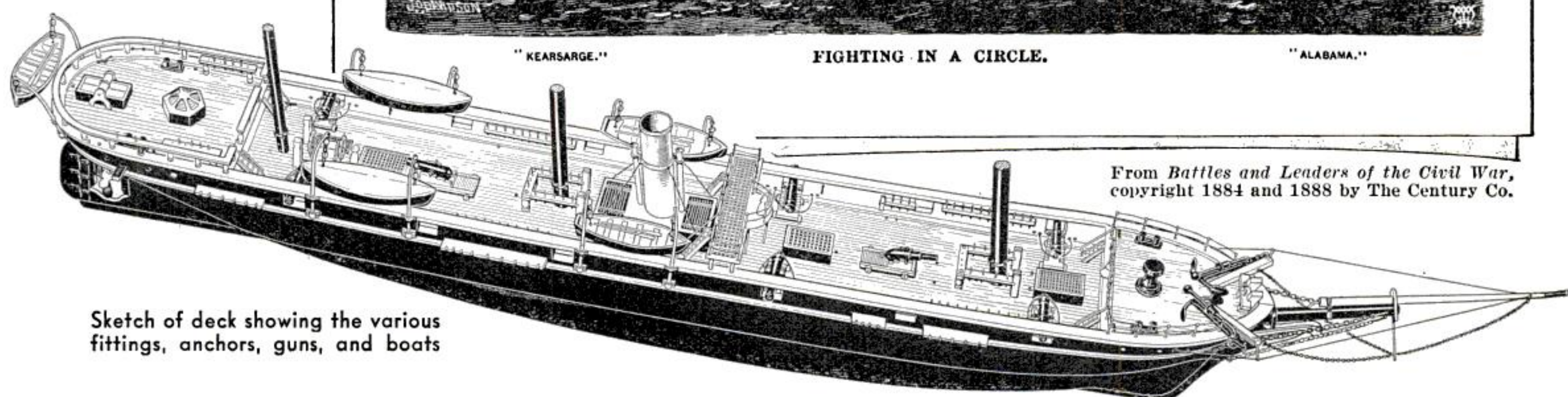
Defeat met the ALABAMA, pride of the Confederate Navy, at the end of her spectacular career when she was sunk after a thrilling battle by the KEARSARGE, a Federal corvette



"KEARSARGE."

FIGHTING IN A CIRCLE.

"ALABAMA."



Sketch of deck showing the various fittings, anchors, guns, and boats

From *Battles and Leaders of the Civil War*, copyright 1884 and 1888 by The Century Co.

## WE START THE DECK WORK ON OUR 'Alabama' Model

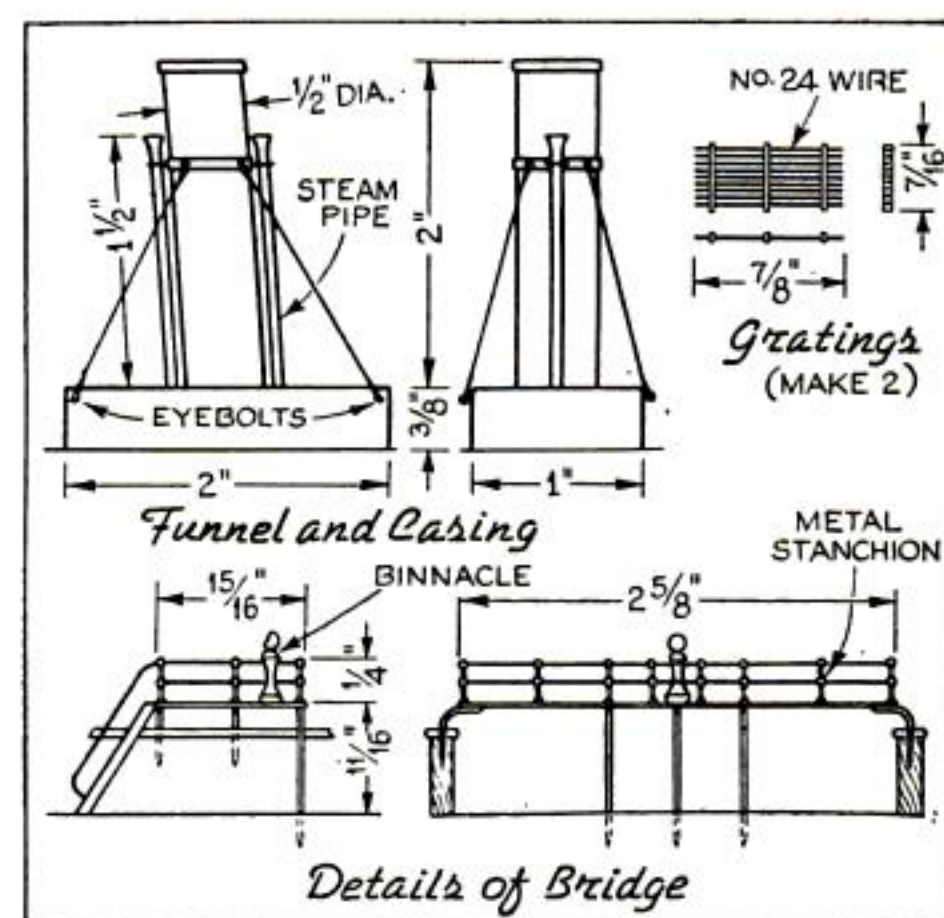
**B**EFORE work can begin on the deck fittings of our new ship model, the famous Confederate commerce raider *Alabama*\*, it is necessary to mark the positions of the masts and bore the holes. Those for the fore and mainmasts are  $\frac{1}{4}$  in. in diameter; that for the mizzenmast,  $\frac{3}{16}$  in. Be very

careful that they are on the midship line and have the correct rake aft, and see that they are vertically in line with the stem.

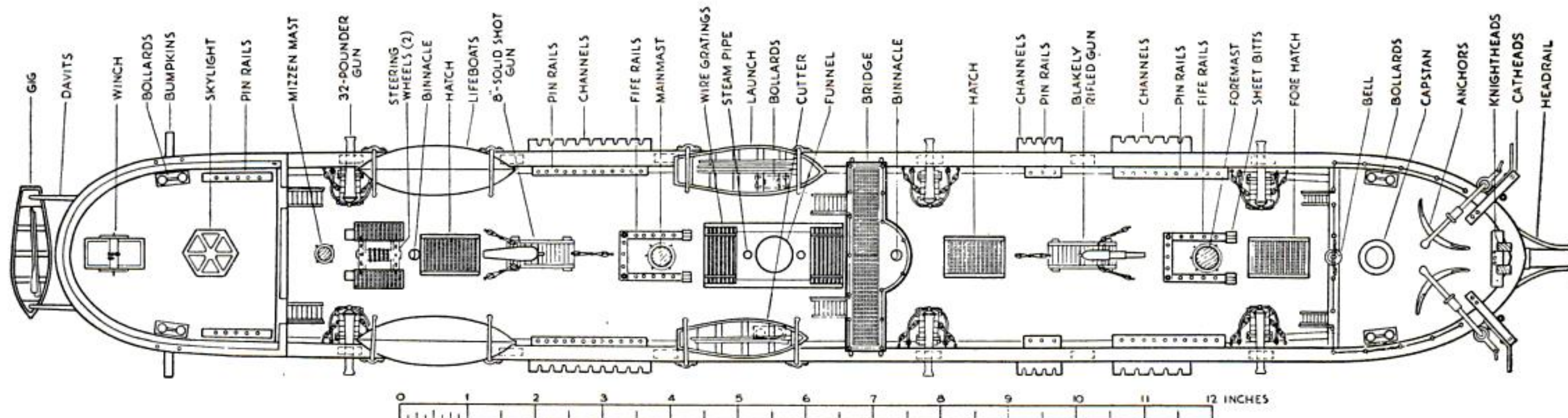
If the hull is solid, it will be sufficient to bore the holes  $\frac{3}{4}$  in. deep. With a hollow hull, the masts can go to the bottom, in which case a nail is set partly into the lower end of the mast, cut off, and pressed into the hull to serve as a dowel.

Around (Continued on page 106)

\*Instructions for building the hull of the model appeared in two preceding installments (P.S.M., Feb. '38, p. 77, and Mar., p. 88).



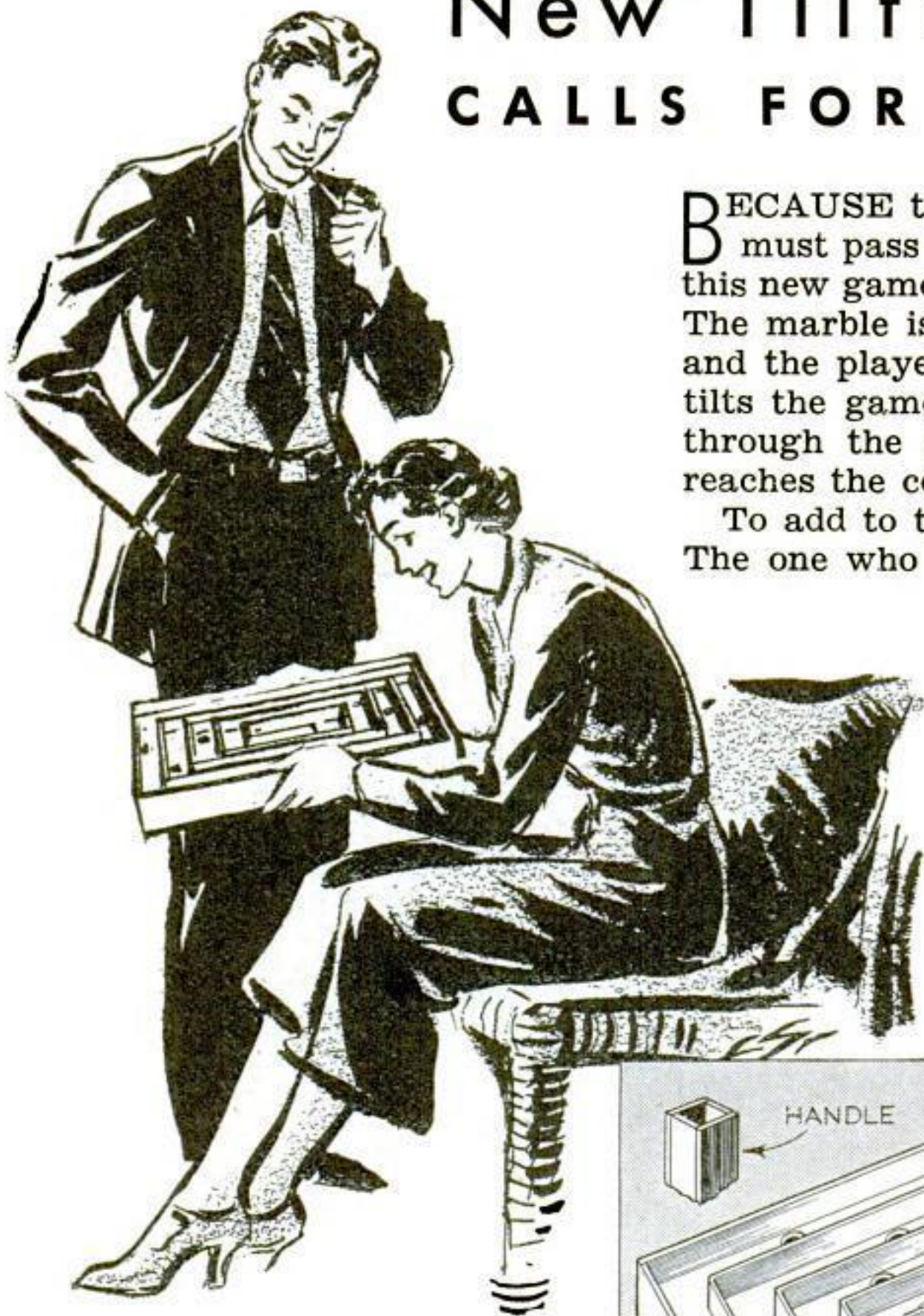
How funnel and bridge are made, and detail of the fiddle or funnel-casing gratings



Deck view with a scale in inches for fixing the location and dimensions of the various parts. Compare with the perspective sketch above



## New Tilting Game CALLS FOR DEXTERITY

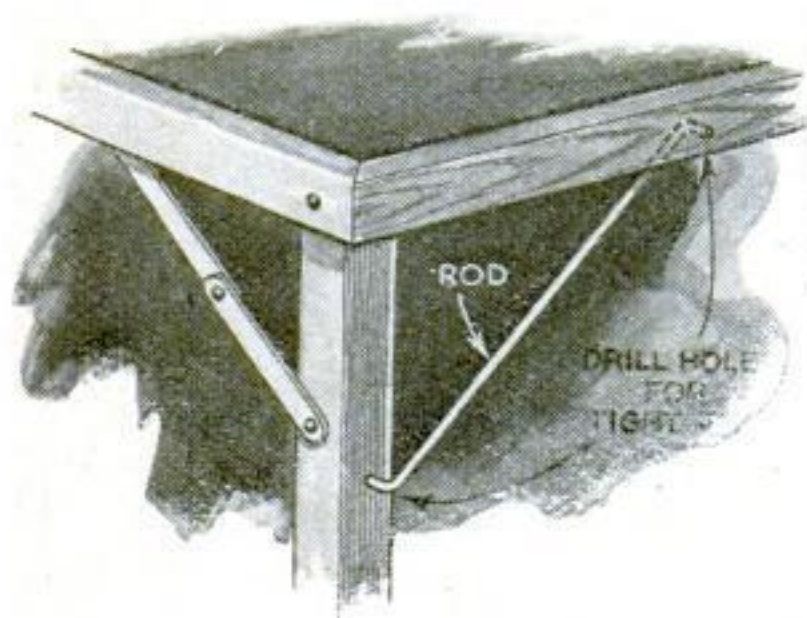
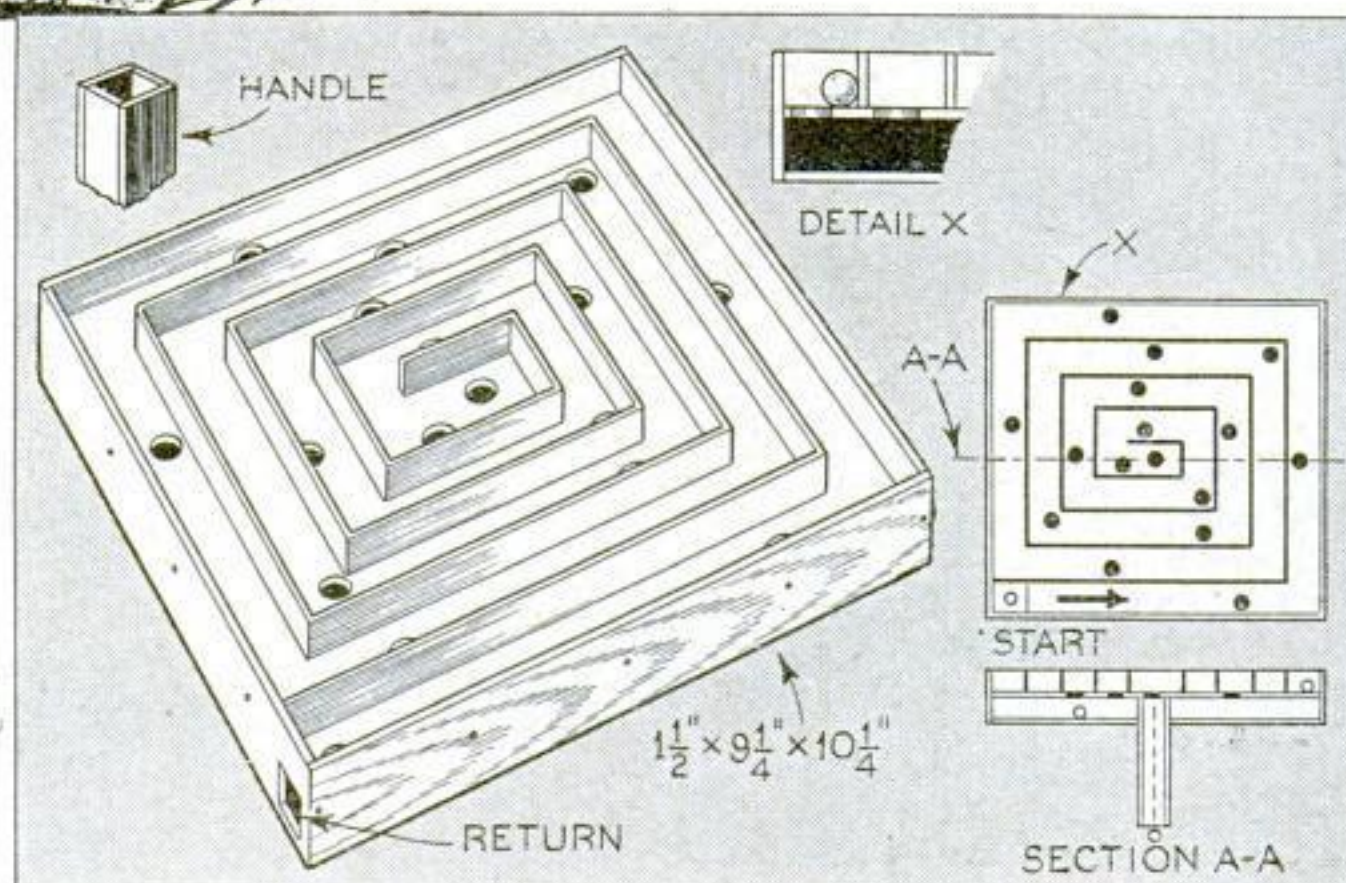


The board has to be tilted in such a way that a marble rolls past traps to reach the center

**B**ECAUSE there are fifteen holes or traps the ball must pass before reaching the goal in the center, this new game "Tilt" requires considerable dexterity. The marble is placed in the corner marked "start," and the player holds the handle with one hand and tilts the game in such a way as to roll the marble through the corridors and past the traps until it reaches the center.

To add to the interest, the players may be timed. The one who rolls the ball to the center so that it falls out of the handle in the shortest time and with the least number of return plays is the winner.

The game is made of  $\frac{1}{8}$ -in. wood, glued and nailed together as shown. The guide rails may be wood or heavy cardboard strips glued in place. Paint the face light blue, the rails and frame yellow, and all the edges black.

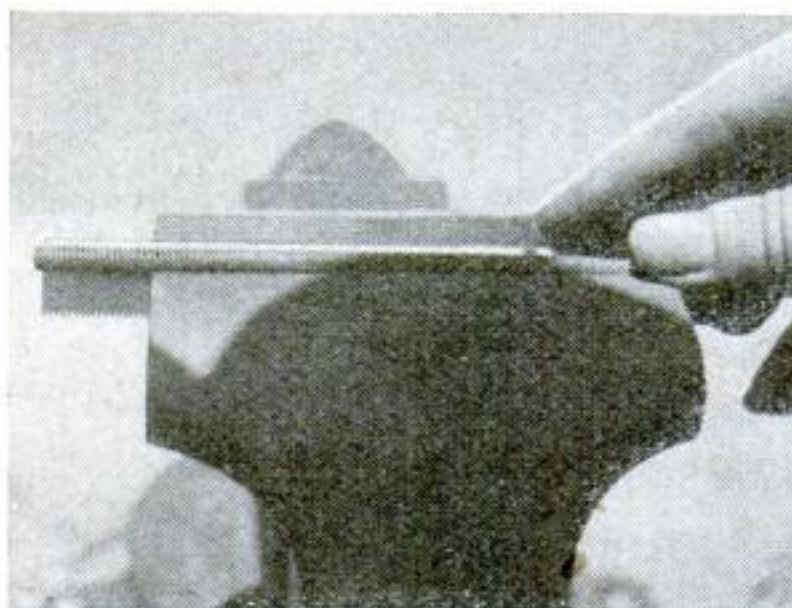


### Bracing Card Tables

**I**NEXPENSIVE card tables often become shaky with use. This may be remedied by adding four braces of the type shown above. They may be cut from the inside member of a five-cent adjustable curtain rod and bent cold. Lacquering improves their appearance. When the table is folded, the rods may be removed or left hanging in the legs or the wooden frame.—R. C. R.

### Threads Pressed into Wood to Form a Special Scale

**R**EQUIRING a temporary rule graduated into tenths of an inch for some model work and having none at hand, the writer improvised one by making the impression of a long  $\frac{1}{4}$ -in./20 threaded rod on a hardwood strip. The strip and threaded rod were placed together in the vise, as shown at the right, with the rod lying along the top edge of the strip. Medium pressure of the vise was then applied to cause the sharp threads to indent the wood, dividing the strip into twenty divisions to the inch. The 1-in. and  $\frac{1}{2}$ -in. divisions were marked with a sharp pencil.

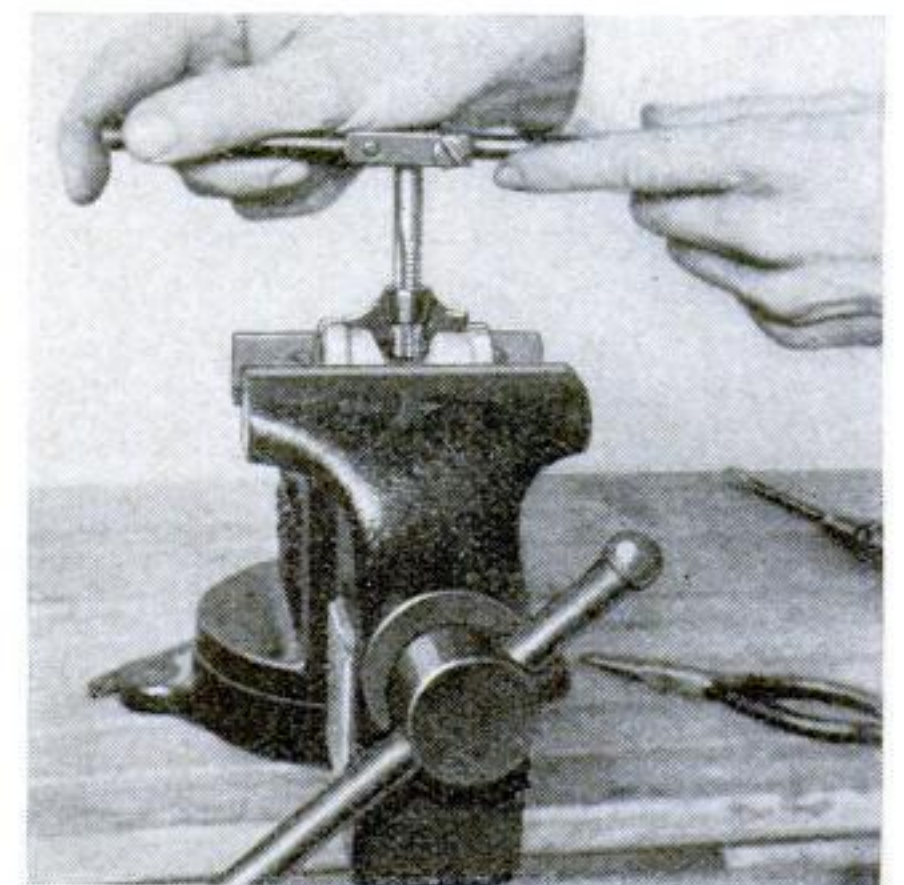


A rod or bolt with the required number of threads to the inch is forced against the edge of a strip of wood to form accurately spaced divisions

### How to Hold Wing Nuts for Rethreading

**O**WING to its shape, a wing nut is difficult to clamp firmly in the vise while rethreading or cleaning the old threads, but a special holder can be prepared in a few moments from an old  $\frac{1}{2}$ -in. pipe tee of malleable iron.

A large V-shaped cut is made in the body of the tee opposite the branch, and a slot about  $\frac{1}{8}$  in. wide is cut from each side of this V along the top of the fitting. The body of the wing nut is placed in the V, and the wings fit in the slots. The vise jaws are tightened on the side of the fitting to clamp the nut in place for the tapping operation.



A malleable-iron pipe tee is cut and slotted so it will hold the wing nut

### Using a Leather Punch

**I**N LEATHER craftwork it is tiresome to have to punch a number of holes with an ordinary revolving leather punch, and one's right hand soon begins to ache. This may be avoided by mounting the punch in a bench vise and feeding the leather to the punch, which is merely pressed, not squeezed.—HAROLD H. KROLL.



### Saw-toothed Cardboard Collar Warns That Bottle Contains Poison

**B**OTTLES containing poison or other chemicals not intended for internal use may be marked with circles of heavy cardboard cut as shown. The hole in the center should fit tightly over the neck of the bottle, and a slit enables the piece to be opened in order to slip it on. Pointed notches cut in the outside edge give unmistakable warning when the bottle is picked up. No matter how dark it is or how hurried he may be, a person cannot fail to note the character of the contents of the bottle as soon as the hand touches the cardboard marker.

Taking but a minute to make this simple gadget may save some one from injury.—R. D. K.



# HOMEMADE Ring Clamps

## HOLD DIFFICULT GLUING JOBS

**I**N MAKING plain miter joints and other more advanced joints, it is often difficult to clamp the various pieces accurately until the glue is dry, but ring clamps of the type illustrated simplify the problem greatly.

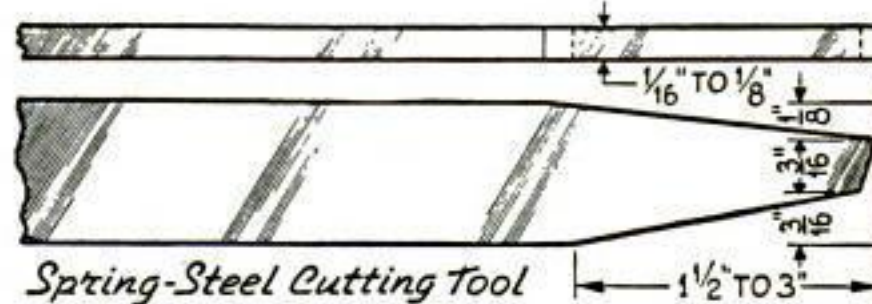
A number of the rings may be cut from a single square of  $\frac{3}{4}$ -in. thick plywood. The material is mounted on the faceplate of a lathe, if available, and the rim is turned smooth. The point of a pencil is held against the disk while it is revolving at a position about  $\frac{3}{4}$  in. from the rim. This is the cutting line for the first ring. The ring is then cut from the disk with a cutting tool formed from a piece of spring steel from  $\frac{1}{16}$  to  $\frac{1}{8}$  in. thick and ground as shown. The taper can be made even longer than indicated if the tool shows any tendency to bind.

By  
**HOWARD R. HEYDORF**

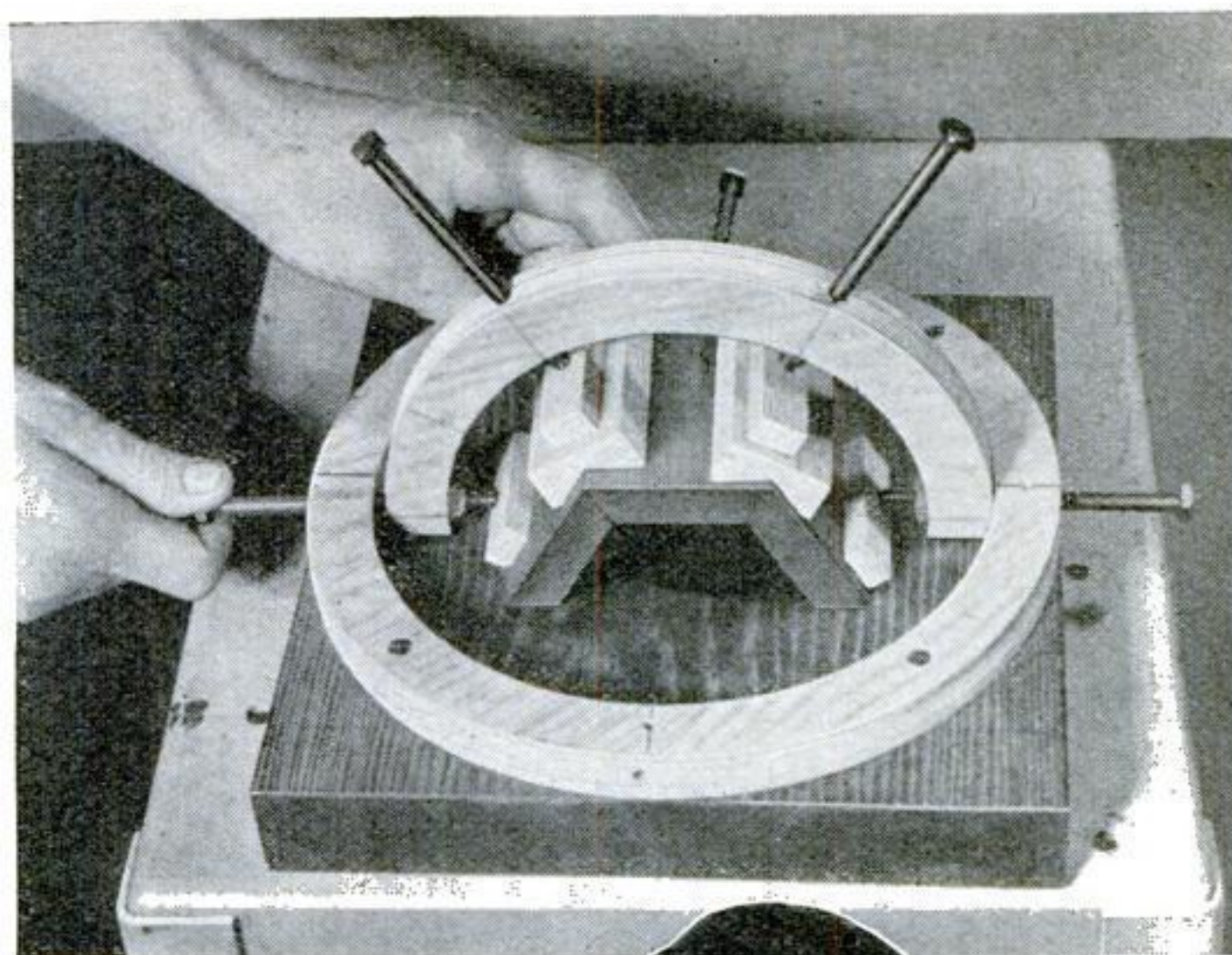
The tool is fed gradually into the work while the lathe is turning at a medium wood-turning speed. The rim is again trued, and the same process is repeated for each ring. If desired, the rings may be cut on a scroll saw by using an adjustable center on which to revolve the work.

There are various ways of applying pressure to the article that is to be clamped. One of the simplest is to use  $\frac{1}{4}$ -in. machine bolts that pass through holes drilled in the rim. To drill these holes, a jig should be made from a large piece of wood on which a center line is scribed. Two strips of wood extend at equal angles from this line, as shown, to center the ring over it. The drill passes through a small guide block, so placed that the bit is in exact register with the center line.

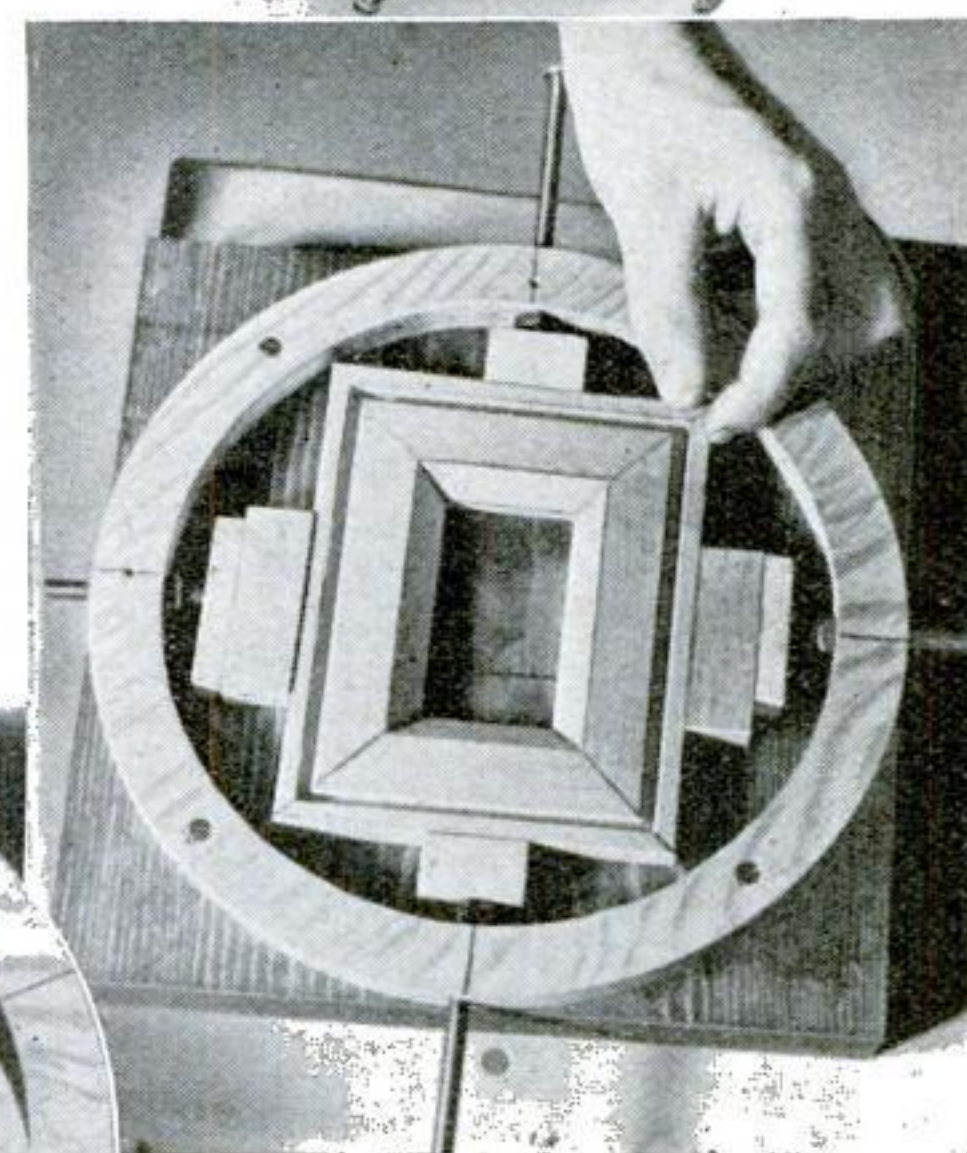
The large rings, which are well suited for clamping mitered frames, may be mounted on a baseboard of 2-in. wood. Holes are drilled through the rim for the bolts in the positions that are most likely to be *(Continued on page 108)*



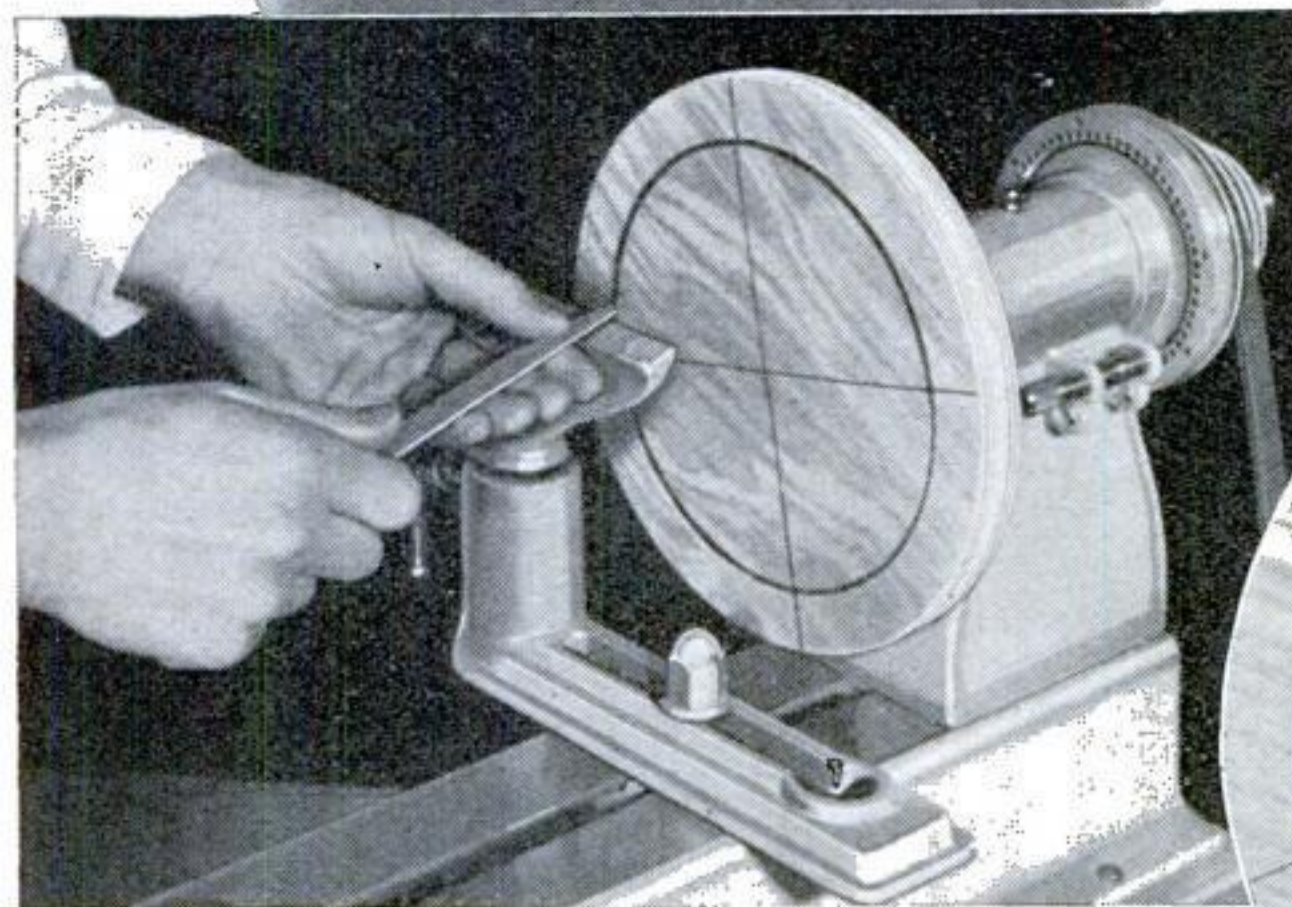
A suggestion for grinding a turning tool with which to cut the rings. Left, a jig improvised for drilling the holes for the machine bolts



Ring clamp used in combination with half of a slightly smaller ring. Below, a six-sided box clamped with one ring. Note the angle blocks



Gluing a mitered frame. Pressure is applied by using  $\frac{1}{4}$ -in. machine bolts that pass through holes in the rim. The work is protected by blocks, which distribute the pressure



The rings are cut from a square piece of  $\frac{3}{4}$ -in. plywood. They can also be made on the scroll saw by pivoting the wood on an adjustable center



# Garden Craftwork

By DICK HIXON

WITH the approach of spring, the home owner's thoughts turn towards the garden. "Isn't there something new I can make this year?" he asks himself. What he wants, of course, is something that will be fun to build as well as useful and decorative.

Suppose, for example, the garage has a blank, homely-looking wall facing the yard. Why not add a dummy window with lattice and flowerpots set in sockets in the extended sill, as shown below?

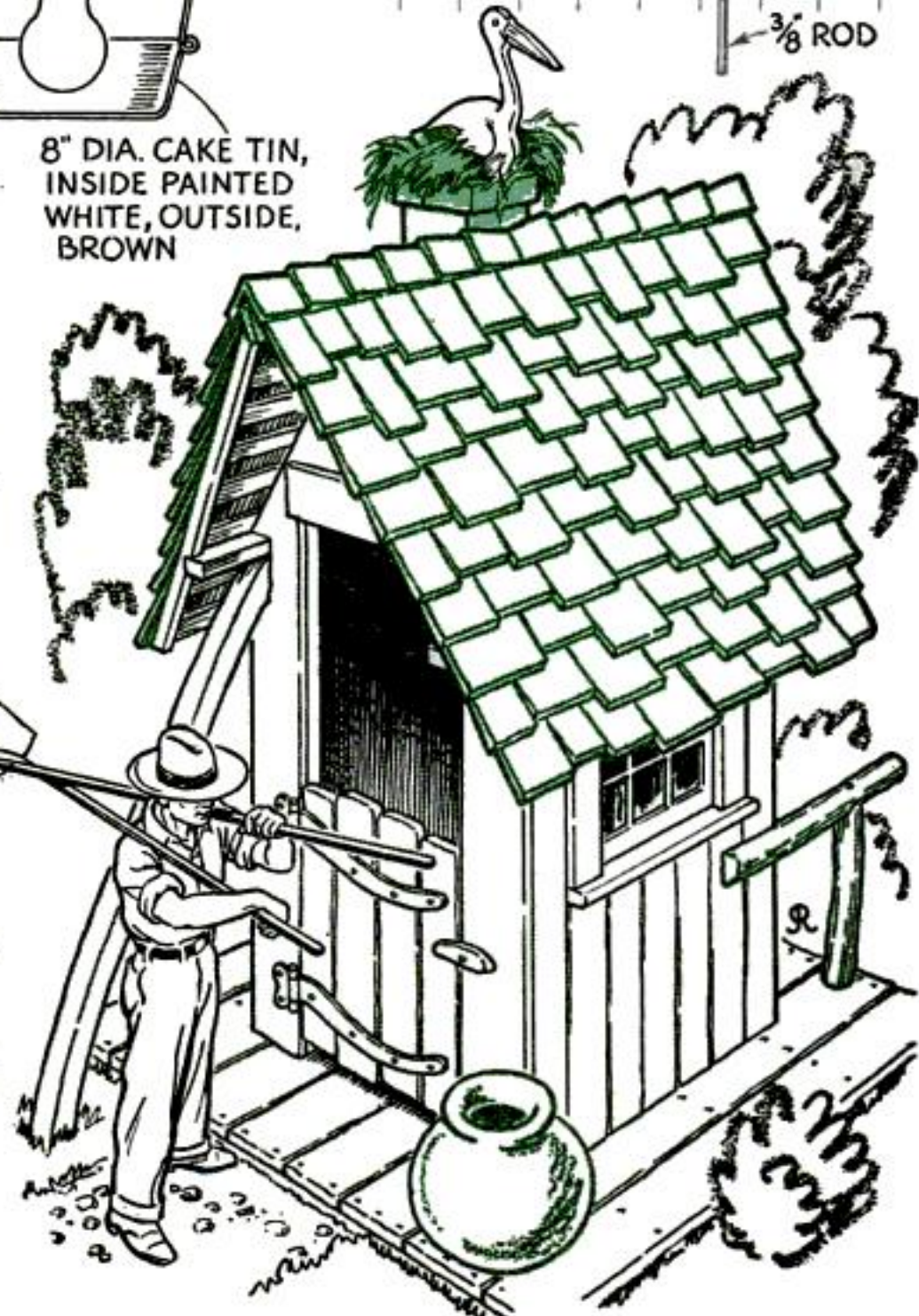
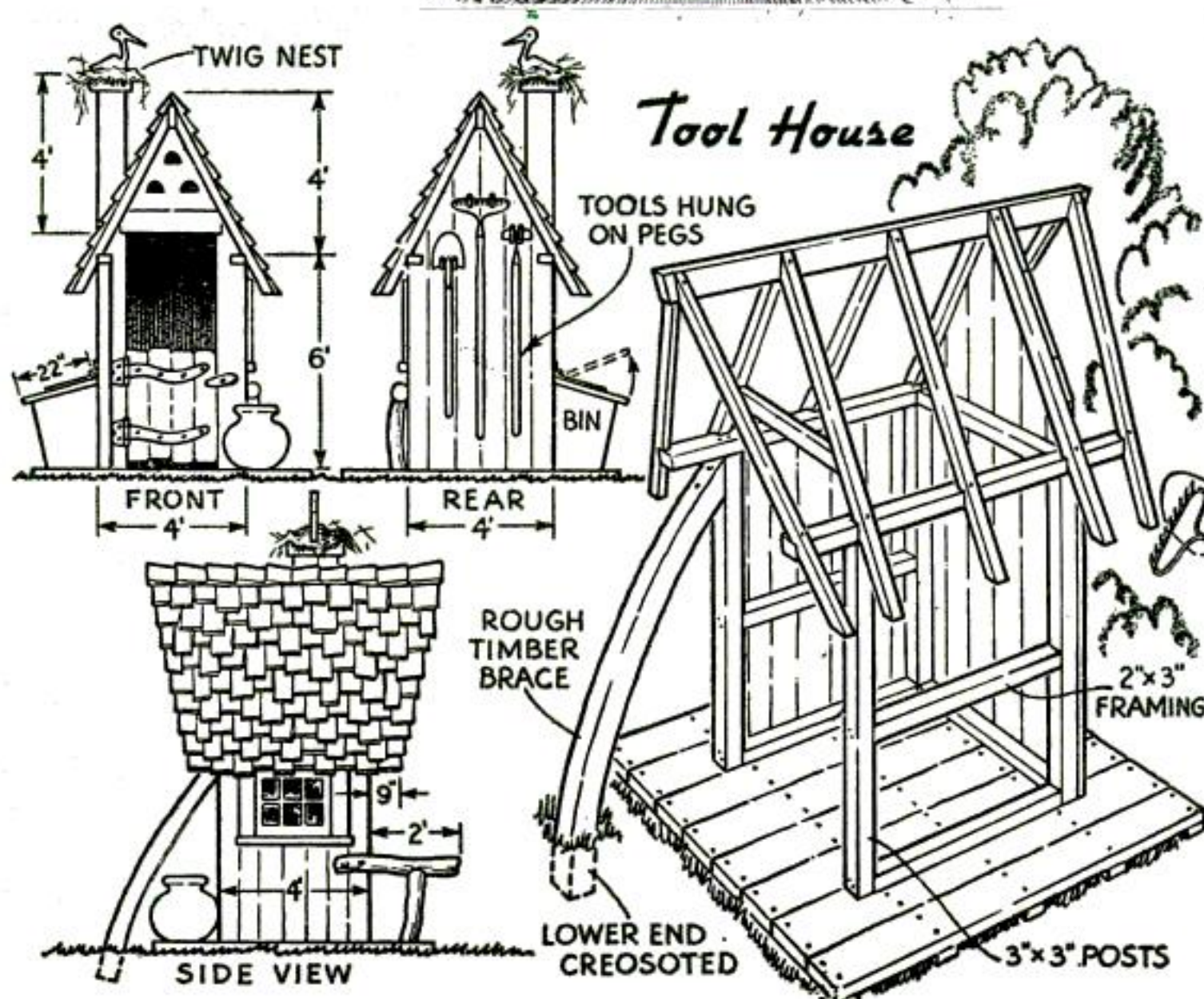
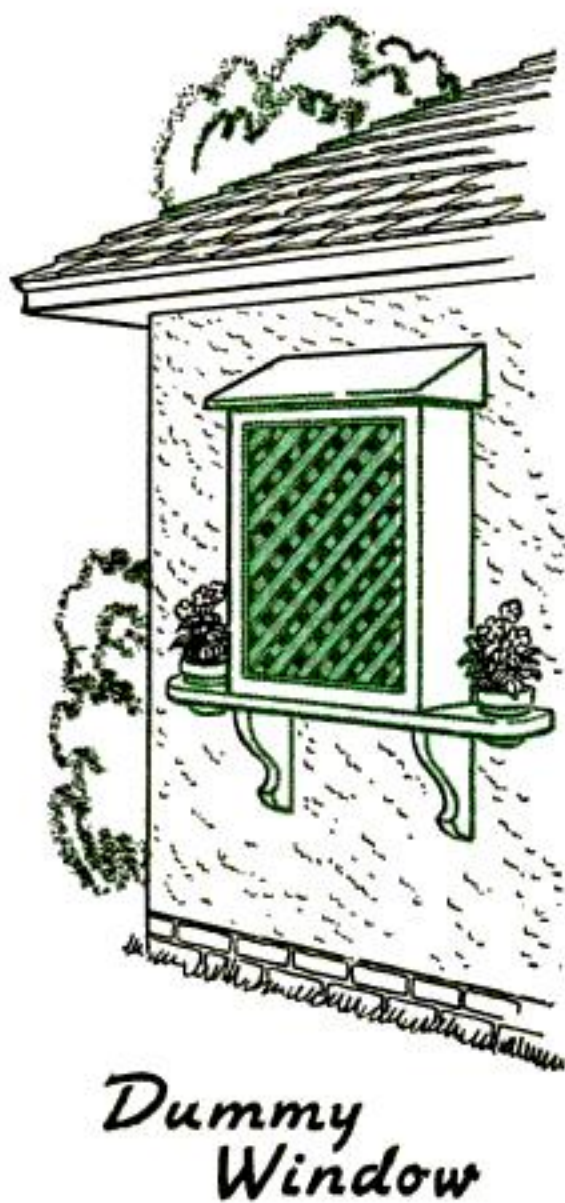
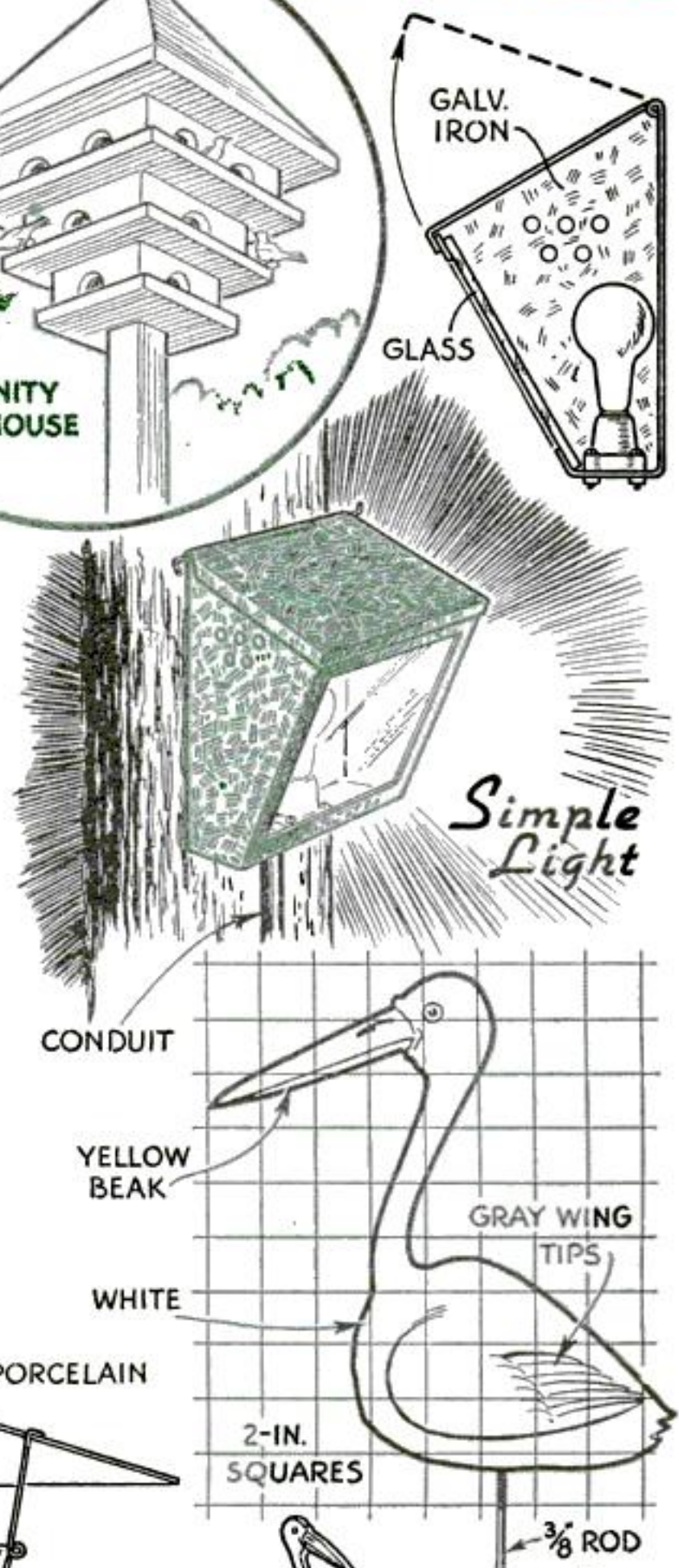
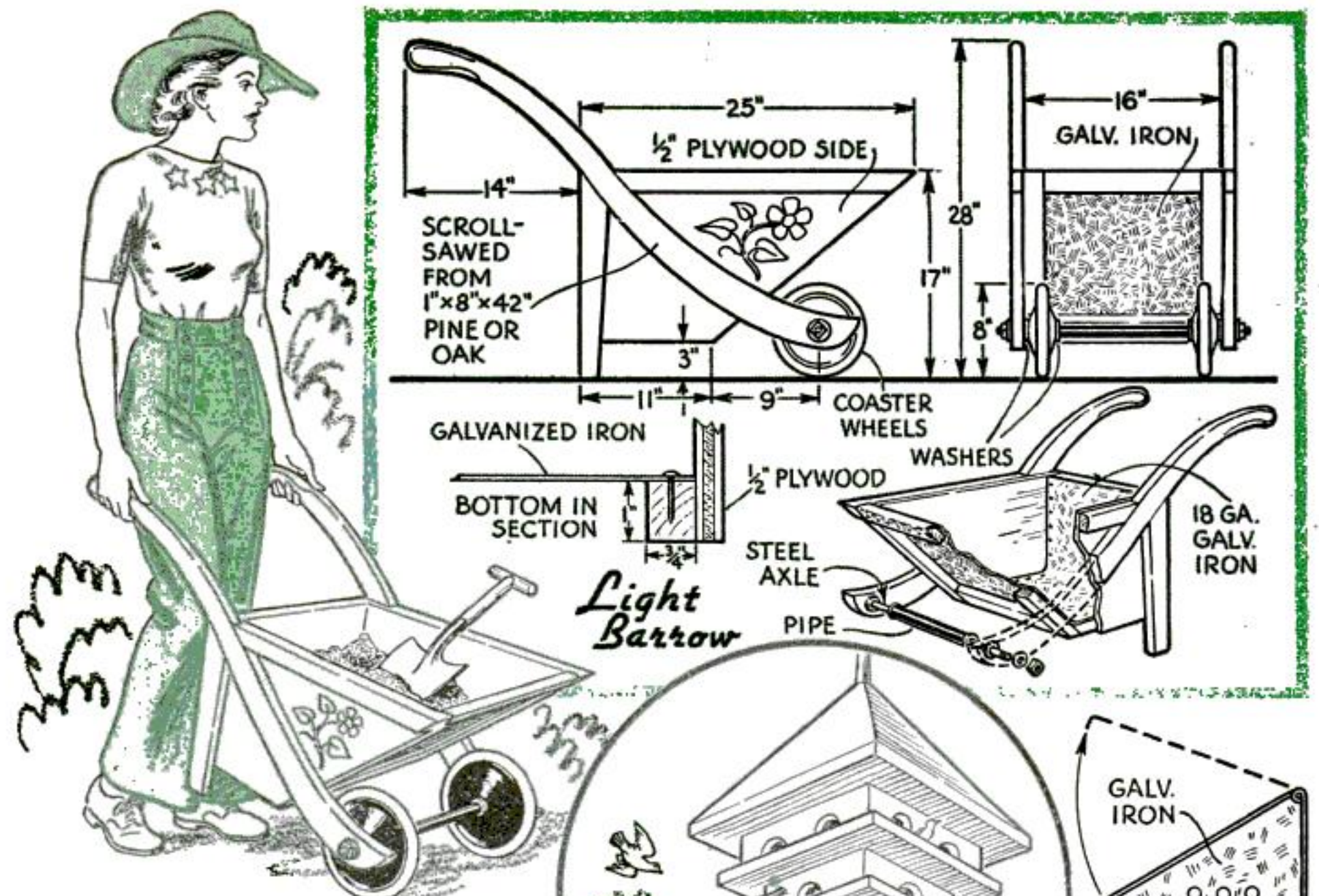
A tool house is almost indispensable if you do much gardening and wish to keep the garden implements handy. The one shown is of board-and-batten construction and holds the lawn mower and a variety of long-handled tools. It also has a bin for leaf mold or fertilizer, and a bench inside for potting.

The barrow illustrated is designed for lightness so that a woman can handle it readily. It dumps by tilting forward.

The lazy lounge is a piece of furniture appreciated by all gardeners. It has a canvas seat and shelves for books or other articles, and shade is provided by a gracefully curved top covered with awning cloth.

Two designs for metal garden lamps are suggested. Both should, of course, be wired with fittings of weatherproof type, approved for outdoor use.

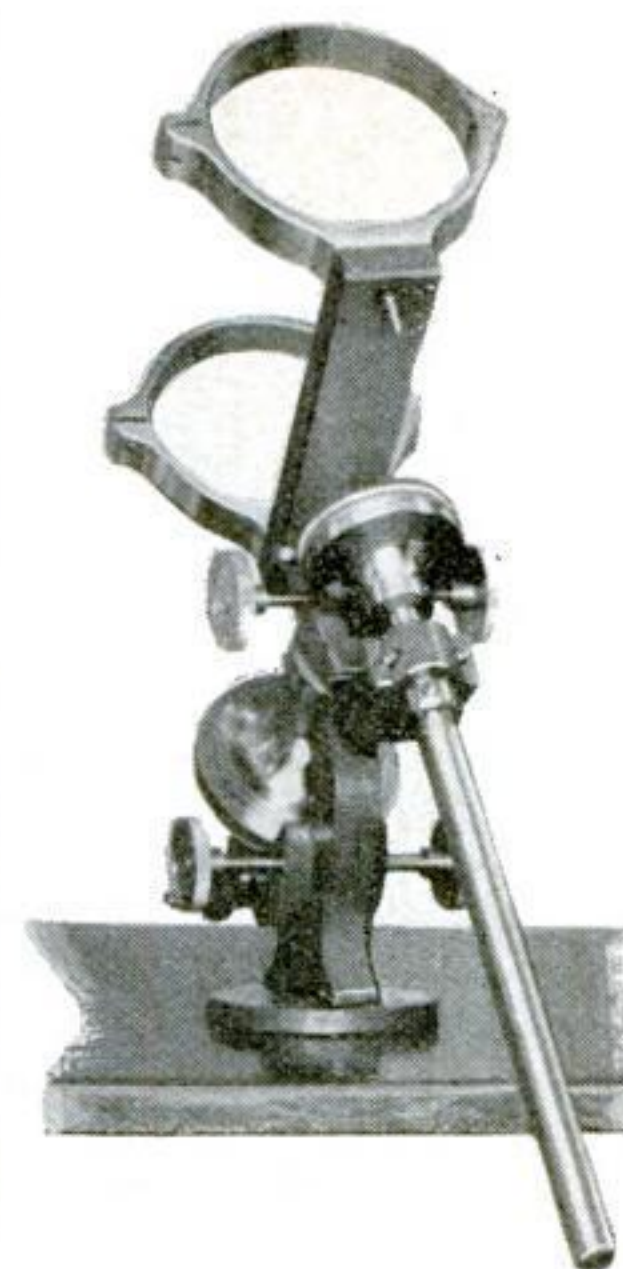
The inverted-pagoda bird house may be constructed from thin wood in any desired size. Assemble the parts with brads and casein glue and make provisions for gaining access to the interior.







Members of the Tri-State Homeworkshop Club, Sioux City, Iowa, with toys they made for poor children. Right, equatorial telescope mounting built by T. W. Stone, of Richmond, Va. It won first prize at a local exhibit



# Guild Helps Home Workshop Clubs

## IMPROVE THEIR PROGRAMS

**A** MARKED improvement in program planning is shown by recent reports of home workshop clubs. To a large extent this is due to the bulletins, contests, and other services that are made available to any group affiliated with the National Homeworkshop Guild. Demonstrations on many phases of the hobby and discussions of technical subjects have become routine occurrences at club meetings throughout the United States and Canada.

Monthly records prepared by the clubs give an excellent idea of how wide a variety of information is disseminated. Uses of the drill press for routing, shaping, and mortising were demonstrated at a recent meeting of the *Oklahoma City (Okla.)* Homeworkshop Club. Period furniture was discussed by the *Vicksburg (Miss.)* Homeworkshop Club. The Tri-State Homeworkshop Club of *Sioux City, Iowa*, listened to a

talk on veneers and the art of veneering. A demonstration of welding and brazing small band-saw blades was the feature at a meeting of the *Ware (Mass.)* Homeworkshop Club.

Moving pictures are often shown at club meetings, and nearly three quarters of the clubs devote considerable time to making and repairing toys for poor children.

The *Mandan (N. Dak.)* Handicraft Club plans to sponsor a series of dances and a carnival this season in order to raise money with which to purchase equipment. A clubroom has been secured which the men use on Mondays and Thursdays, and the women's division uses on Tuesdays and Fridays. Wednesdays and Saturdays are open nights.

Frank Murnane has donated his workshop for the Spindle City Homeworkshop Club, *Cohoes, N. Y.*, and the members have decided to equip it with



Guild members at Beach, Va., made a club workshop out of what was once a corn crib

power tools. The first machine to be selected was a jig saw. Veneering was demonstrated by Mr. Murnane at a recent meeting.

The *Saginaw (Mich.)* Homeworkshop Club gave a fish dinner for members and their wives . . . Five hundred toys were made by the *Nanticoke (Pa.)* Homeworkshop Club for distribution among poor children . . . Meetings of the *Plymouth (Mass.)* Homeworkshop Club are held in the [\(Continued on page 116\)](#)

## REVISED BULLETIN OFFERED FREE BY GUILD

**P**ACKED with information and brought right up to date, the National Homeworkshop Guild's free introductory bulletin contains complete instructions on how to start a home workshop club in your neighborhood. In it you will find advice on how to obtain the names of prospective members, where to hold meetings, how to conduct meetings, and methods of obtaining publicity.

The bulletin also contains a suggested form of constitution and by-laws, pointers on how to build the club into a strong and growing organization, and



Official Magazine  
POPULAR SCIENCE  
MONTHLY

a charter application blank. As soon as your club is started and the application accepted, the club will receive regular bulletins, job sheets, and other benefits.

Membership in the Guild is absolutely free, and is open to any home workshop club the members of which are at least sixteen years of age. All activities are strictly nonprofit and noncommercial.

Write for a copy of the bulletin now. Use the coupon at the right or send a letter and ask for Bulletin 16A. Be sure to inclose a large, stamped, and self-addressed envelope.

National Homeworkshop Guild  
347 Fourth Avenue, New York

Please send by return mail your revised bulletin on how to organize a home workshop club in my neighborhood. Be sure to inclose full information on how my friends and I can become members of the National Homeworkshop Guild. I understand that this is free and will not place me under any obligation.

For your use in sending this material, I am inclosing a large (legal size), stamped, and self-addressed envelope.

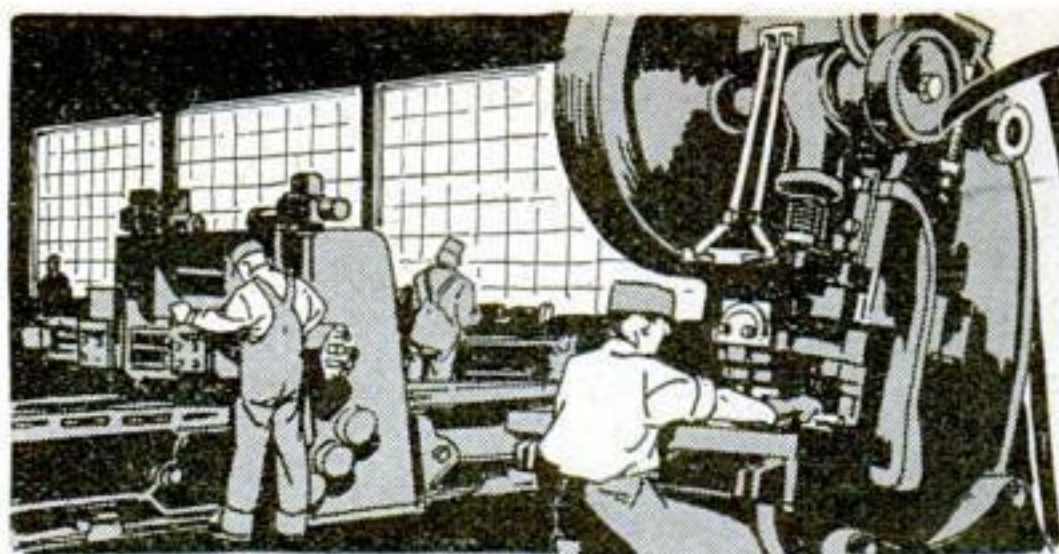
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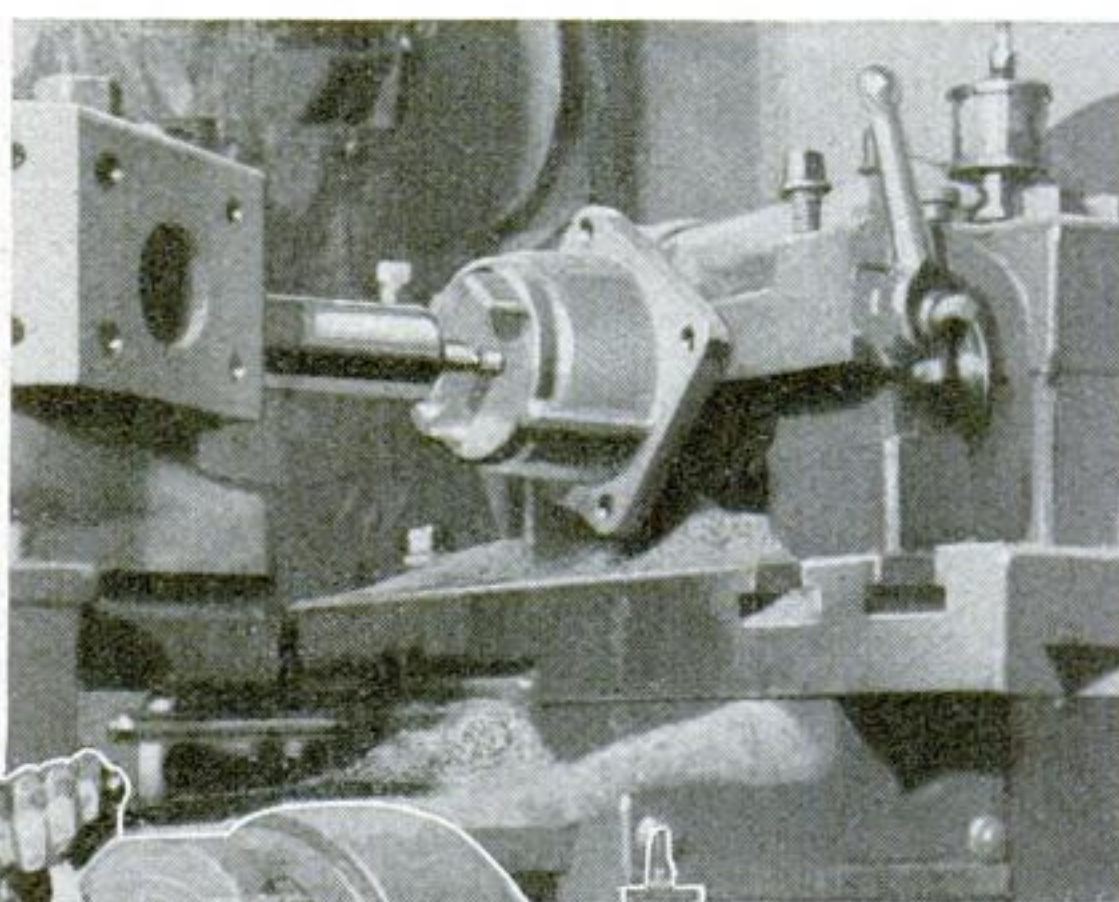
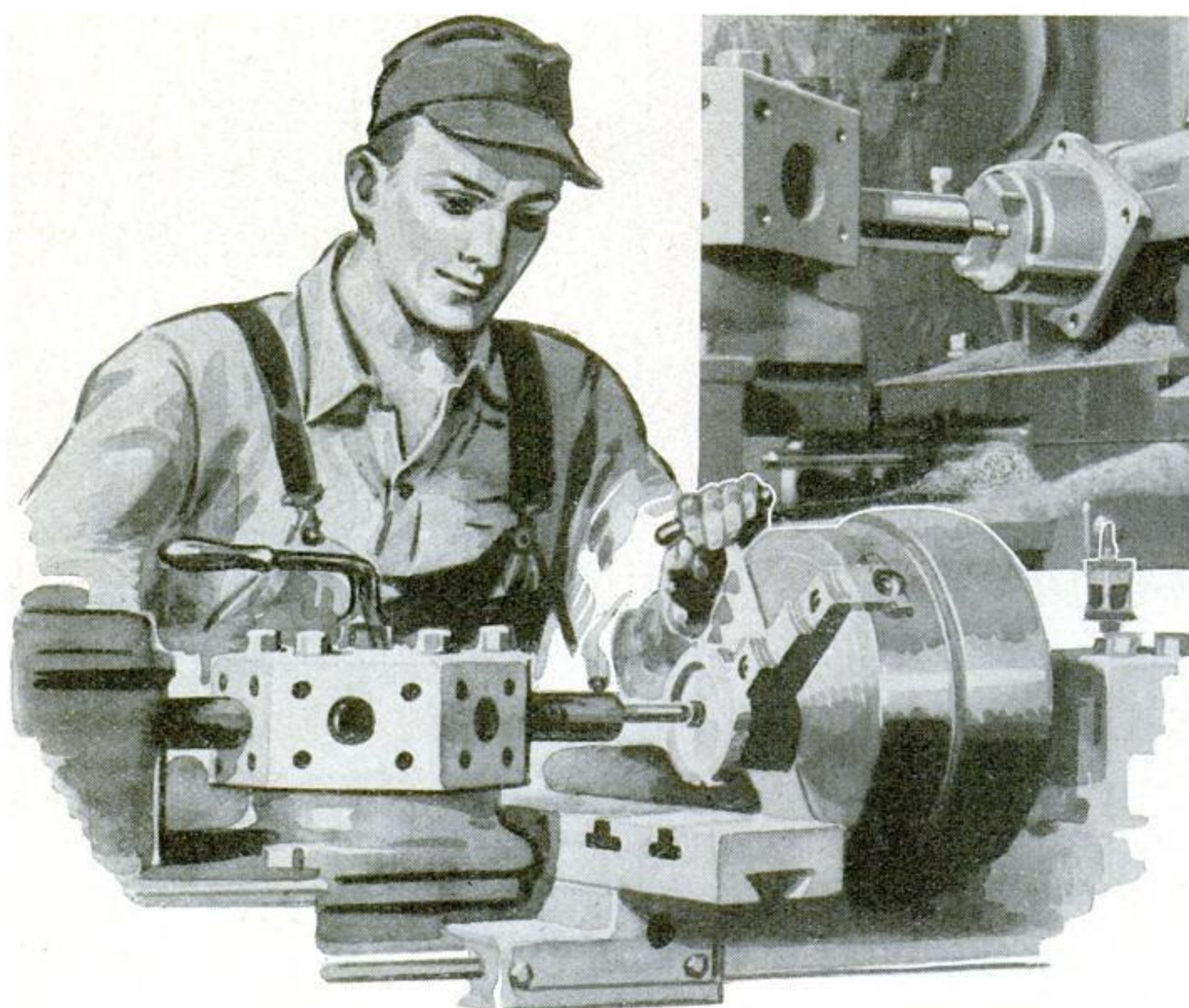




# Better SHOP Methods

## Special Hold-in Center

SPEEDS UP AWKWARD LATHE WORK

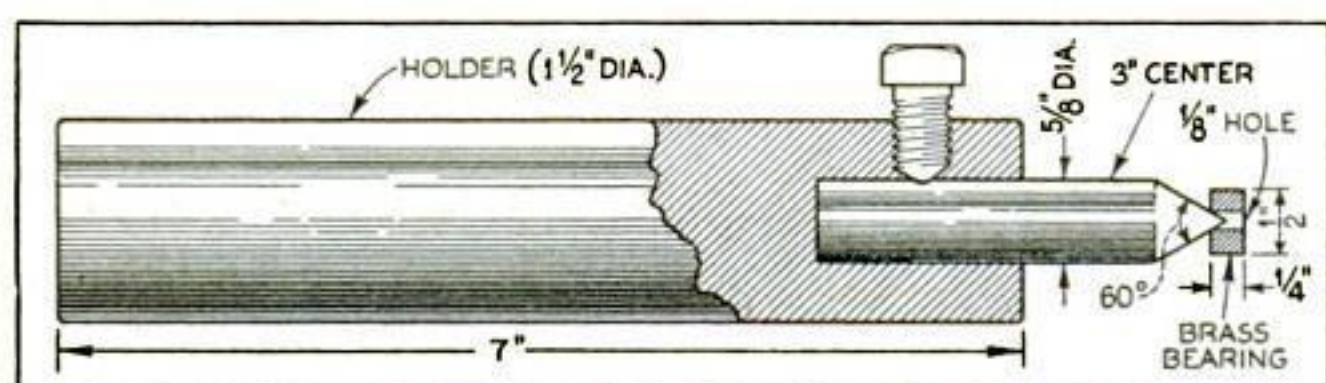


HERE is a turret-lathe center devised for three classes of nerve-racking, hard-to-chuck work. These jobs are: thin-walled castings that crack or bend if held tightly; irregular work that offers but little hold; and large castings of awkward shapes.

The important feature of the device is a small brass bearing, which rests on the work and into which the center is pushed. With the turret carriage locked firmly, the work is thus held in while being machined.

Make the center with a 60-deg. taper point from  $\frac{5}{8}$ - or  $\frac{3}{4}$ -in. diameter cold-rolled steel, or tool steel, hardened for long wear. Two centers are usually needed, one 3 in. long and the other 6 in. long to reach over the tool rest and into the bottom of deep castings. The center is slipped into a  $1\frac{1}{2}$ -in. deep hole in a piece of 7-in. long cold-rolled steel, which fits the hole in the turret. A set screw is used to keep the center in place.

The bearings are made several dozen at a time from  $\frac{1}{2}$ -in. diameter brass stock through which a  $\frac{1}{8}$ -in. hole has been drilled. Simply cut the brass into  $\frac{1}{4}$ -in. lengths. No counter-sinking is necessary. It does not matter whether the bearing revolves or remains stationary on the center. The important thing is that the small bearing surface furnishes a constant "push" to hold the work from slipping out of the chuck.—O. R. S.

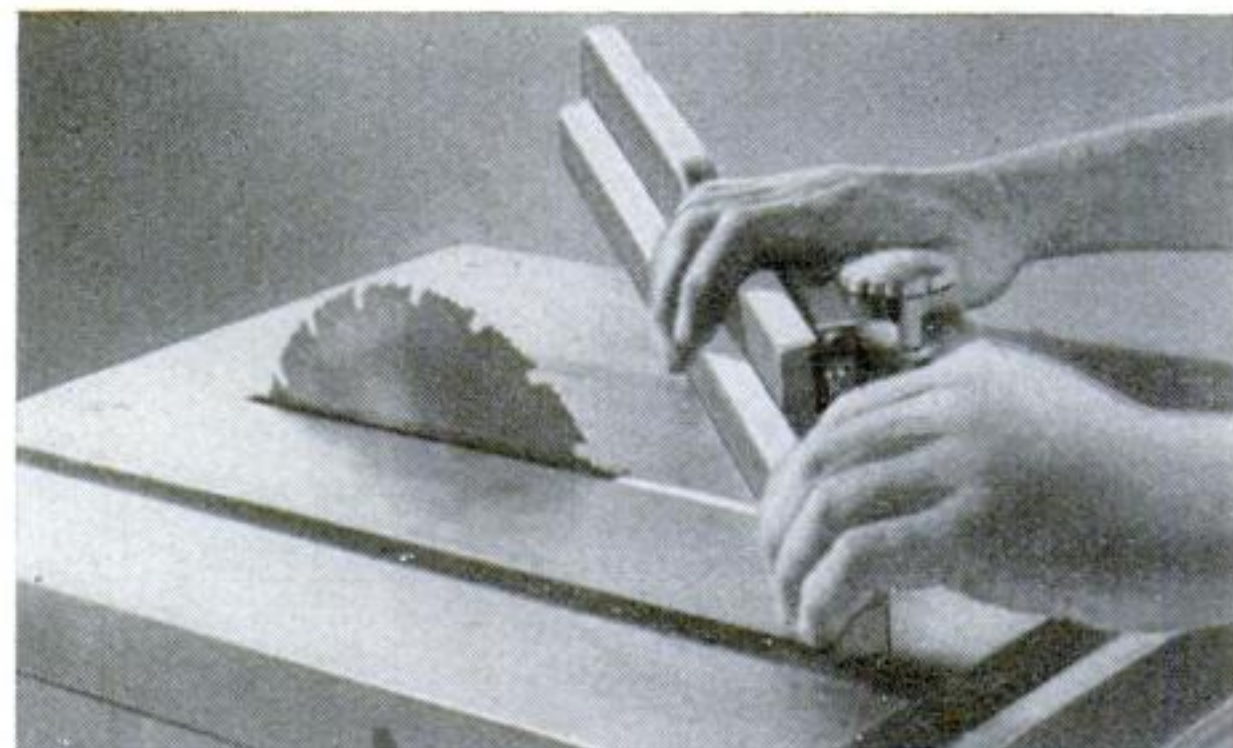


The center holds in work which does not give the chuck jaws a good grip. Above, using the center on thin work that might be cracked if held tightly by the internal expansion chuck

## Circular Saw Table Improved by Inlaying a Metal Guide Line

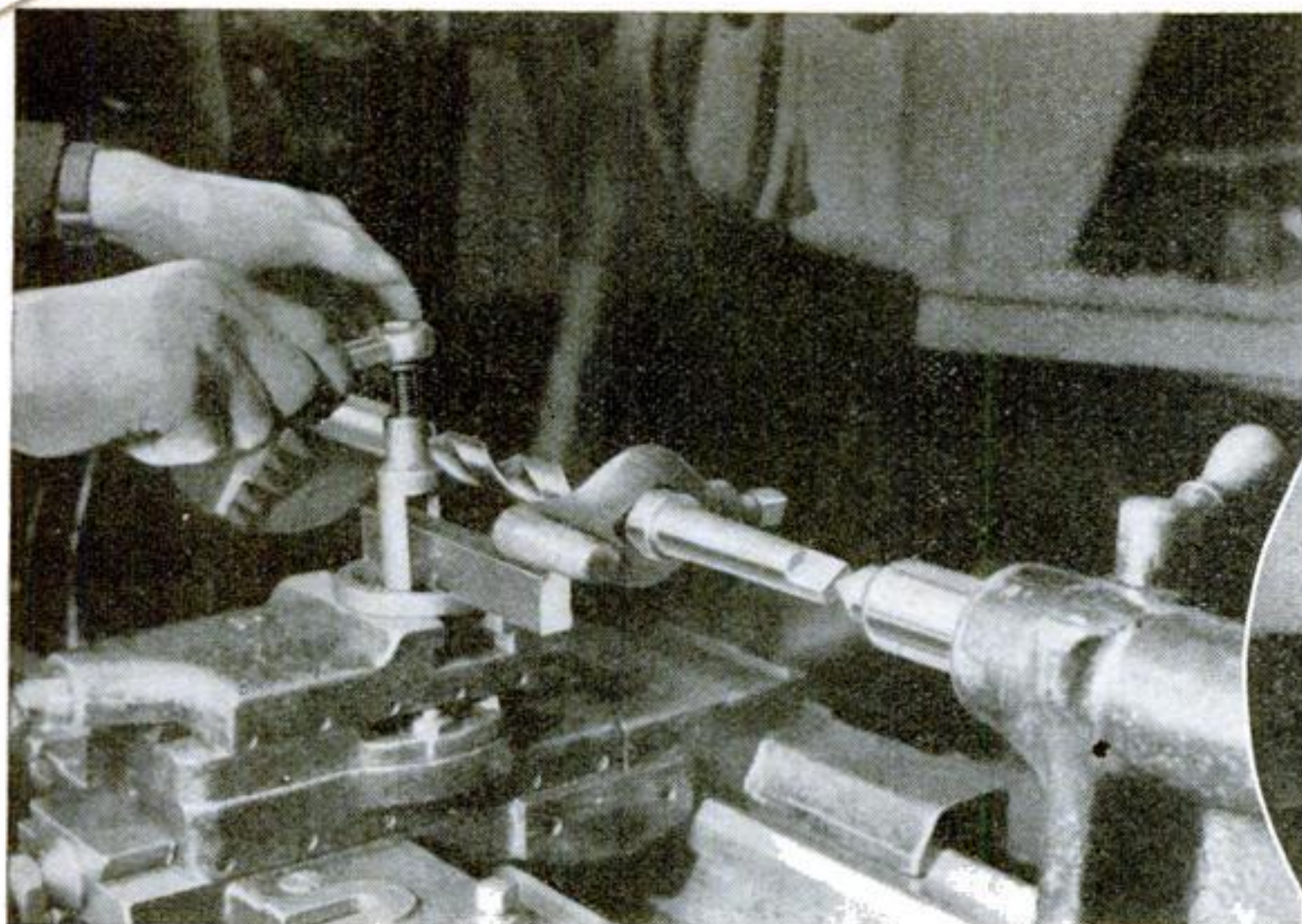
IF THE table of an ordinary bench circular saw is marked in line with the saw blade as shown at the right, time can be saved in doing various types of work and more accurate results may be obtained. For example, the line acts as a warning of the path of the saw when cutting large pieces of wood. It also serves as a guide when the mark happens to be on the back of the board to be cut. Best of all, when moldings have to be cut, it shows the exact point where the miter will come on the back of the molding, therefore it is easy to cut miters without transferring marks or making careful measurements.

The line is made by filing a shallow slot in the saw table with the edge of a file. The slot should be the exact width of the saw cut. After it has been cleaned with acid or soldering flux, a contrasting metal is melted and run into the groove. Nickel babbitt is a good filler for this purpose because it melts easily and retains its brightness permanently. Smooth the metal down so it is level with the rest of the table.—GEORGE MAGEE.



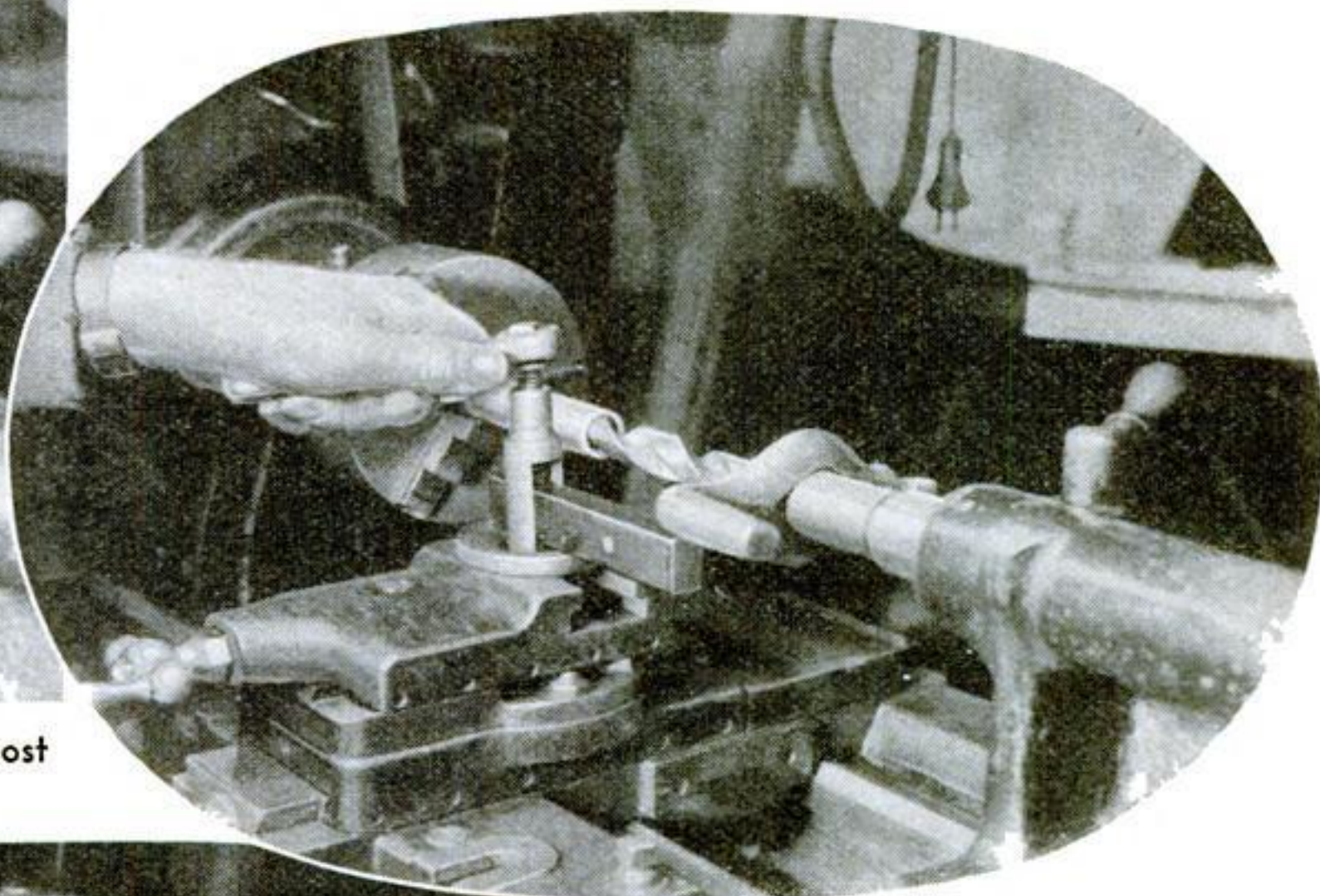
A groove exactly the width of the saw kerf is filed in the table and filled with metal to show the cutting path





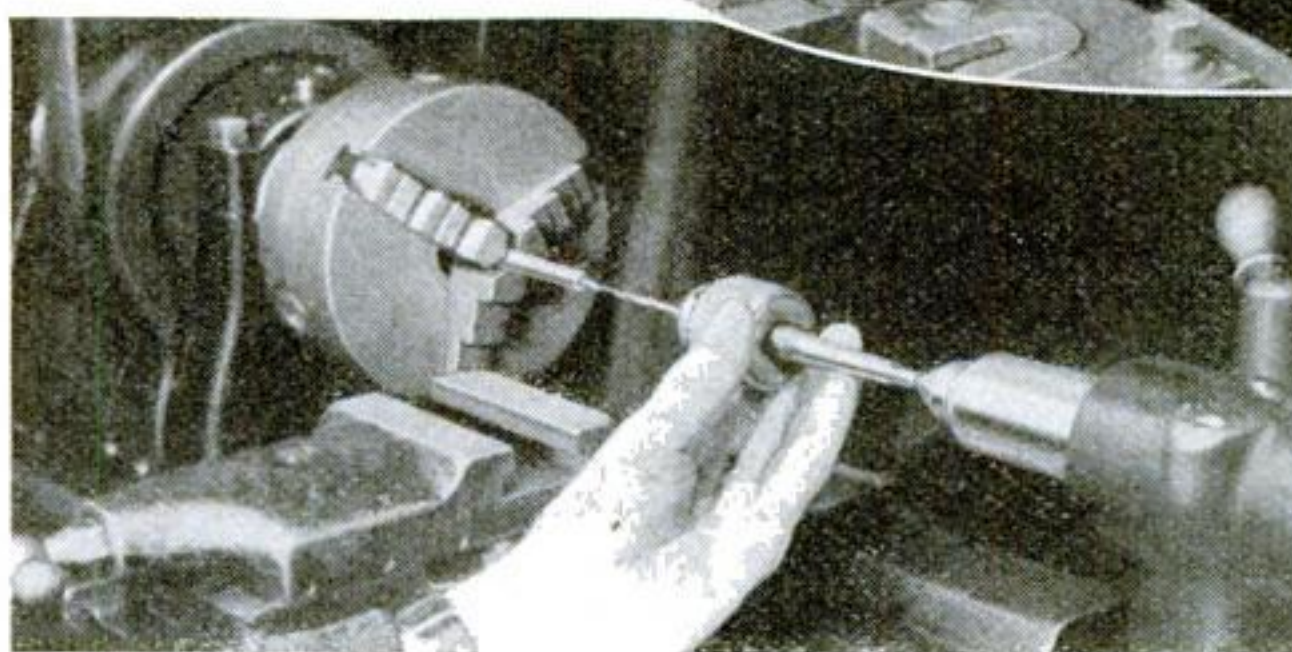
The lathe dog on the drill is supported by a block held in the tool post

## Hints on Drilling Accurately with the Lathe Tailstock



**T**HE most accurate way to drill holes is, of course, to hold the drill stationary and revolve the work because the drill then tends to run to the center of the work. Very accurate holes may be drilled in a lathe by placing the work in the lathe chuck and supporting the drill with the tailstock center. On heavy drilling, the drill bit may be kept from revolving by the use of a lathe dog, which in turn is supported by a block in the tool post, as shown in the photograph above.

When drilling large holes in which only a reasonable degree of accuracy is necessary, the taper shank of the drill may be tapped into the tailstock center socket as shown in the oval. In this case, always place a dog on the drill and support the dog by a block in the tool post. If this is not done and



If only a reasonable degree of accuracy is required, a taper-shank drill may be set in the tailstock socket and kept from turning by a dog

A small drill may be held in a chuck as shown at the left. This helps prevent breakage

the drill should turn in the tailstock, the accuracy of the lathe may be permanently injured.

For light work, a small drill may be held in the drill chuck, and the drill chuck kept from revolving by holding it with the fingers, as shown in the third view. This also has the advantage of practically eliminating the breakage of small drills, as the chuck will turn under strain.

## Cutting High-Carbon Metals with Oxyacetylene

**I**N CUTTING high-carbon or spring steel and cast iron with an oxyacetylene torch, there is one stumbling block. That is the slag which forms in the cut and protects the metal below it. Spring steel, such as automobile bumpers, is less difficult to cut than cast iron, but the appearance of the cut is more or less ragged. We use about one third more oxygen pressure on spring steel than on mild steel of the same thickness.

The average small shop rarely has to contend with cutting cast iron. If, however, a job turns up, use a large tip—about the size for cutting steel of four times the thickness—and oxygen pressure about three times that required for steel. Take the shortest cut through the piece and weave the torch back and forth across the cut as you proceed. If you lose the heat, clean out the cut before you start again.

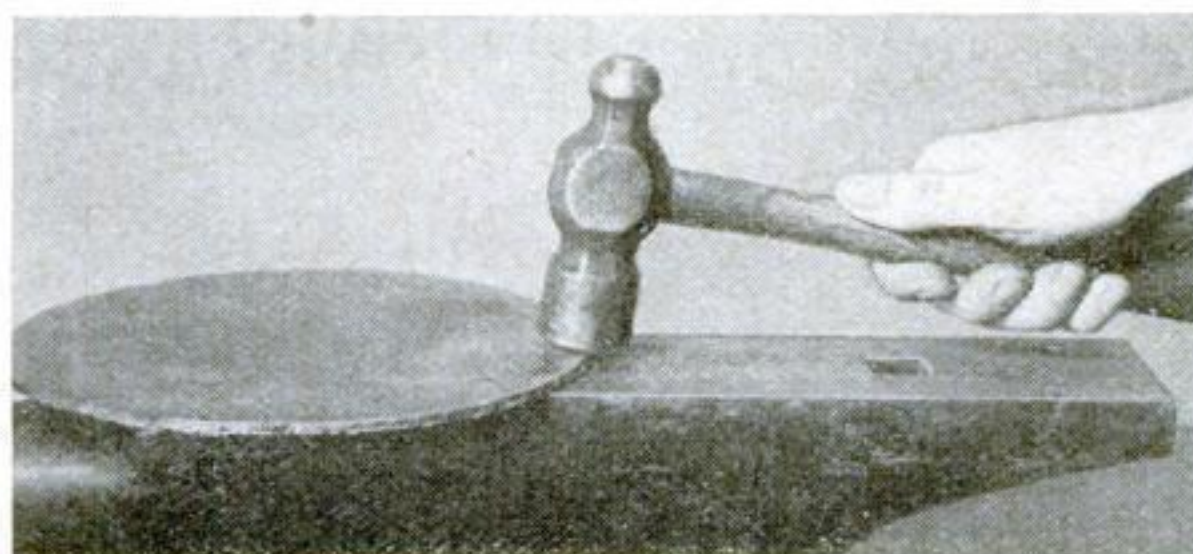
Another difficulty often experienced is with shrinkage. When steel is rolled into sheets, especially if thin, the metal is stretched. As soon as a cut is made across the sheet, the tension is relieved and the metal shrinks. If a sheet-steel disk is cut, for example, it will assume a saucer shape. To remedy this, place the cut edge of the sheet on an anvil or

block of iron and peen the edge. With a little practice, you can make a disk lie perfectly flat.

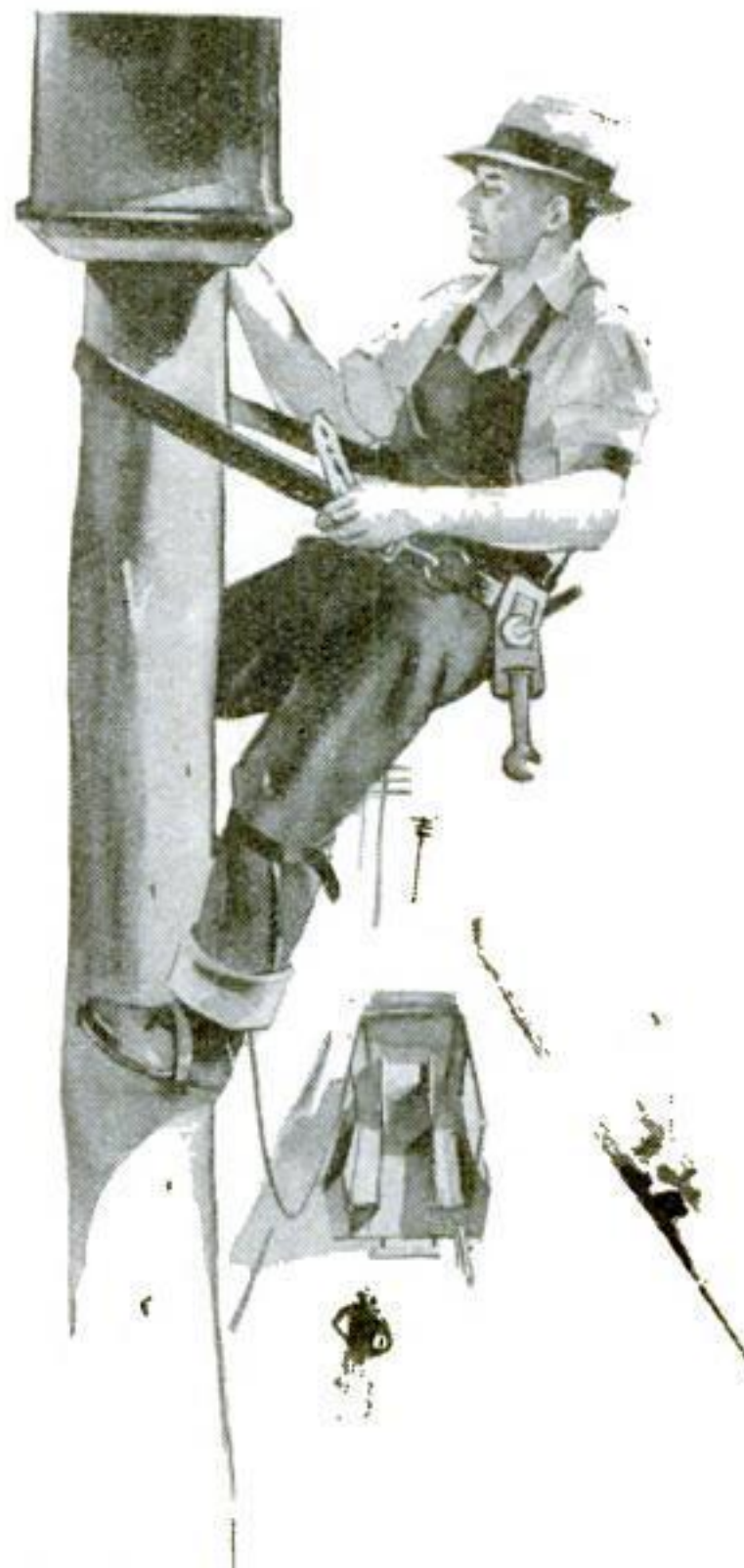
After considerable use, the tip of a torch becomes crusted with fine particles of metal. These should be removed and the end of the tip kept smooth and bright. If you have to clean a cutting jet, be careful not to destroy the smooth bore or nick its outlet, as that might deflect the jet and cause a crooked cut.

Sparks and drops from a cutting torch are molten steel. Experience has taught us to wear gloves, preferably leather, and tuck the gauntlets inside our sleeves; also to avoid trousers with cuffs and to keep our shoe tops covered with the legs of the trousers.—W. C. CHENEY.

*This is the third in a series of short articles on the use of oxyacetylene torches.*



Disks cut with the oxyacetylene torch tend to become saucer shaped, but can be flattened by careful peening



## Wrench Kept Handy in Leather Holder

**W**HEN a lineman, machinist or other mechanic uses one particular wrench a great deal, it pays to make a holder as shown from a piece of leather belting or any heavy piece of leather about 3 by 6 in. It keeps the wrench ready for use and protects the clothing.—H. R. WALLIN.

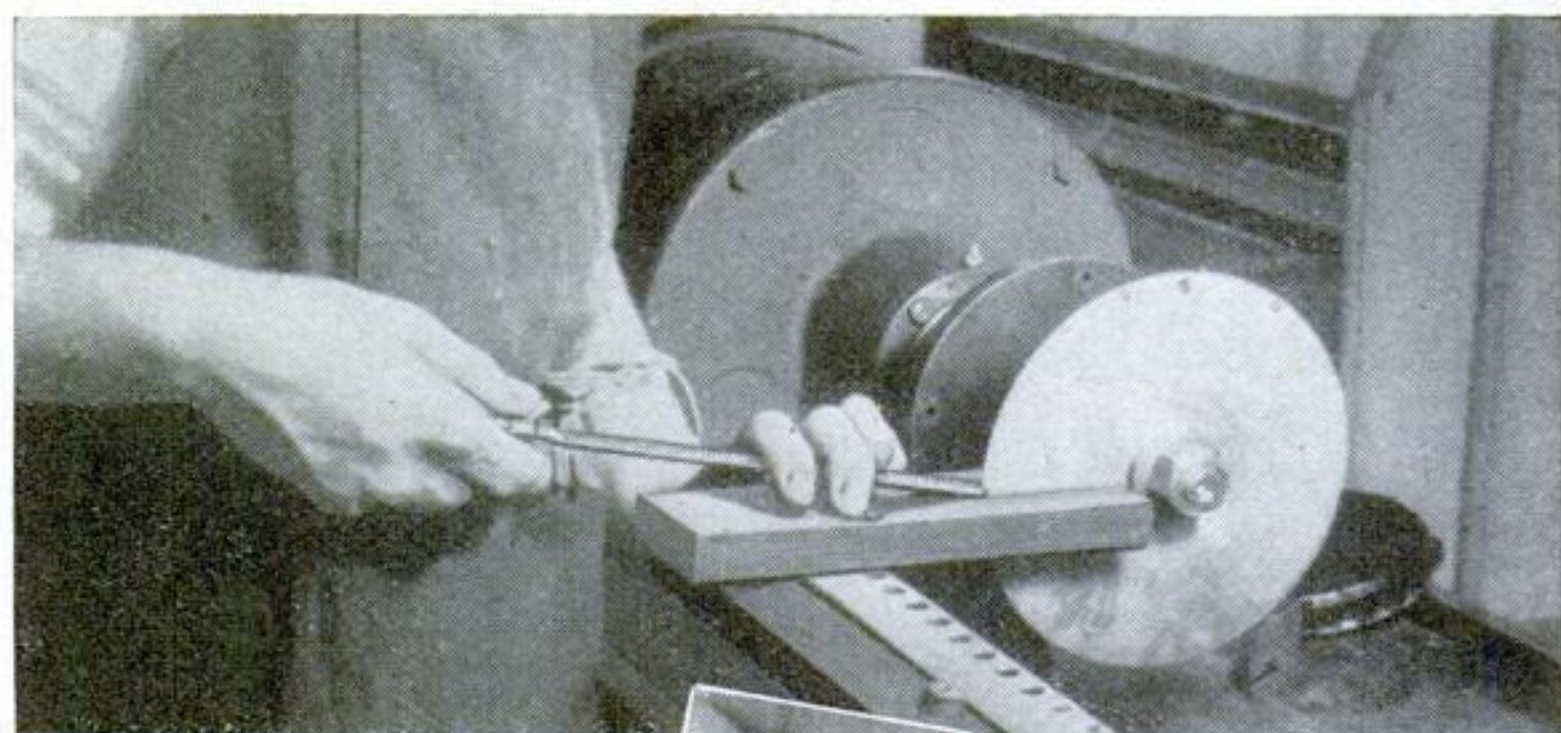


# Diamond-Charged Disk

QUICKLY CUTS GEMS AND MINERAL SPECIMENS

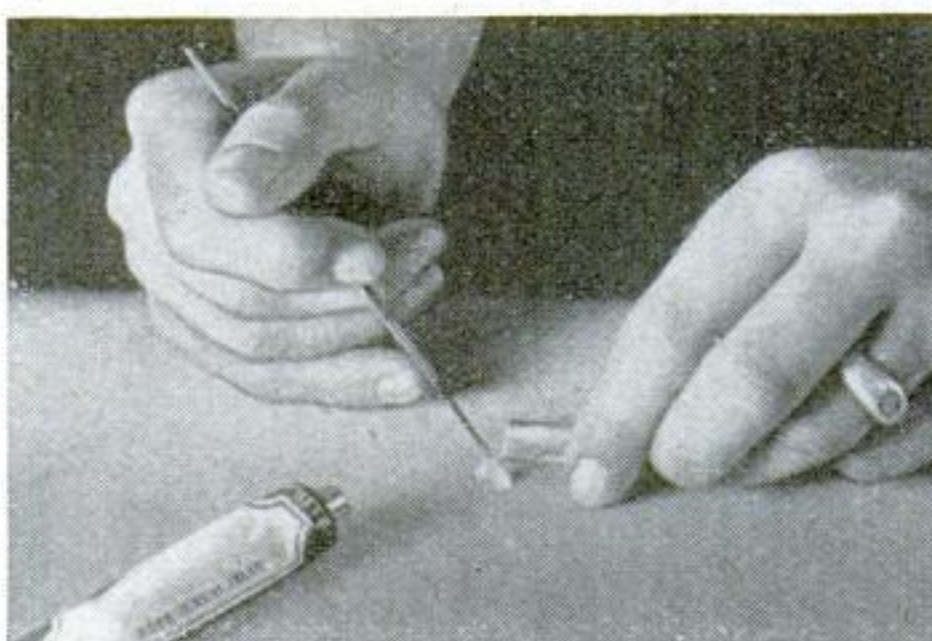
By  
W.T. Baxter

Material to be cut is cemented to wood and fed against the disk, the lower part of which runs in oil



The first step in preparing the hard-rolled copper or iron disk is to true it up. In this case an old file, ground sharp, is the tool

Next, the periphery of the disk is notched as at right with a knife and lightweight hammer



Bortz diamond powder, which is relatively inexpensive, is mixed with a light grease



After the diamond paste has been applied, the notches are closed by hammering them

A newly charged disk will not saw to best advantage until it has been used a short time and the metal has worn down to expose all the diamond dust. Then, since the diamond is about 1,000 times as hard as quartz, the disk will cut several hundred blanks for

*cabochons* before it loses its charge, when it may be recharged. Always run the disk in the same direction, and do not try to cut hollow, cracked, or porous materials, because loose particles may become lodged in the disk and tear out some of the diamond dust.

Because of its many advantages, the diamond-charged disk is rapidly finding favor with amateur gem cutters. It is used by most professionals because of the clean cut it makes and the time it saves over other methods of sawing.

## Odd Divisions Laid Out by Using Thread Gauge

OCCASIONALLY one wants to divide inches into odd fractions, such as sevenths, ninths, or elevenths, when sketching or laying out work. By using an ordinary thread gauge, almost any division can be obtained from one to forty an inch. The points of the gauge are sharp enough to indicate exact measurements. My gauge reads from nine to forty, but if fewer than nine divisions are wanted, I use two or more teeth of a higher number. For example, if seven divisions are required, use the alternate teeth of the fourteen leaf.—F. SEVER.

**R**OUGH gem materials, mineral specimens, and other very hard materials are easily cut with a disk of the type illustrated. Made of hard-rolled copper or iron, the disk has diamond powder embedded in its periphery. This readily divides rocks and pebbles into pieces suitable for grinding into *cabochons* for use in rings and brooches (see P.S.M., Dec., '36, p. 63).

An 8-in. disk of 20-gauge metal is suitable for all ordinary purposes, although other thicknesses will serve equally well. The disk should revolve through a slot in a board upon which the mineral to be cut is held. The mandrel must, of course, be true, and an 8-in. disk should revolve about 450 r.p.m., or at a speed of approximately 900 surface feet a minute.

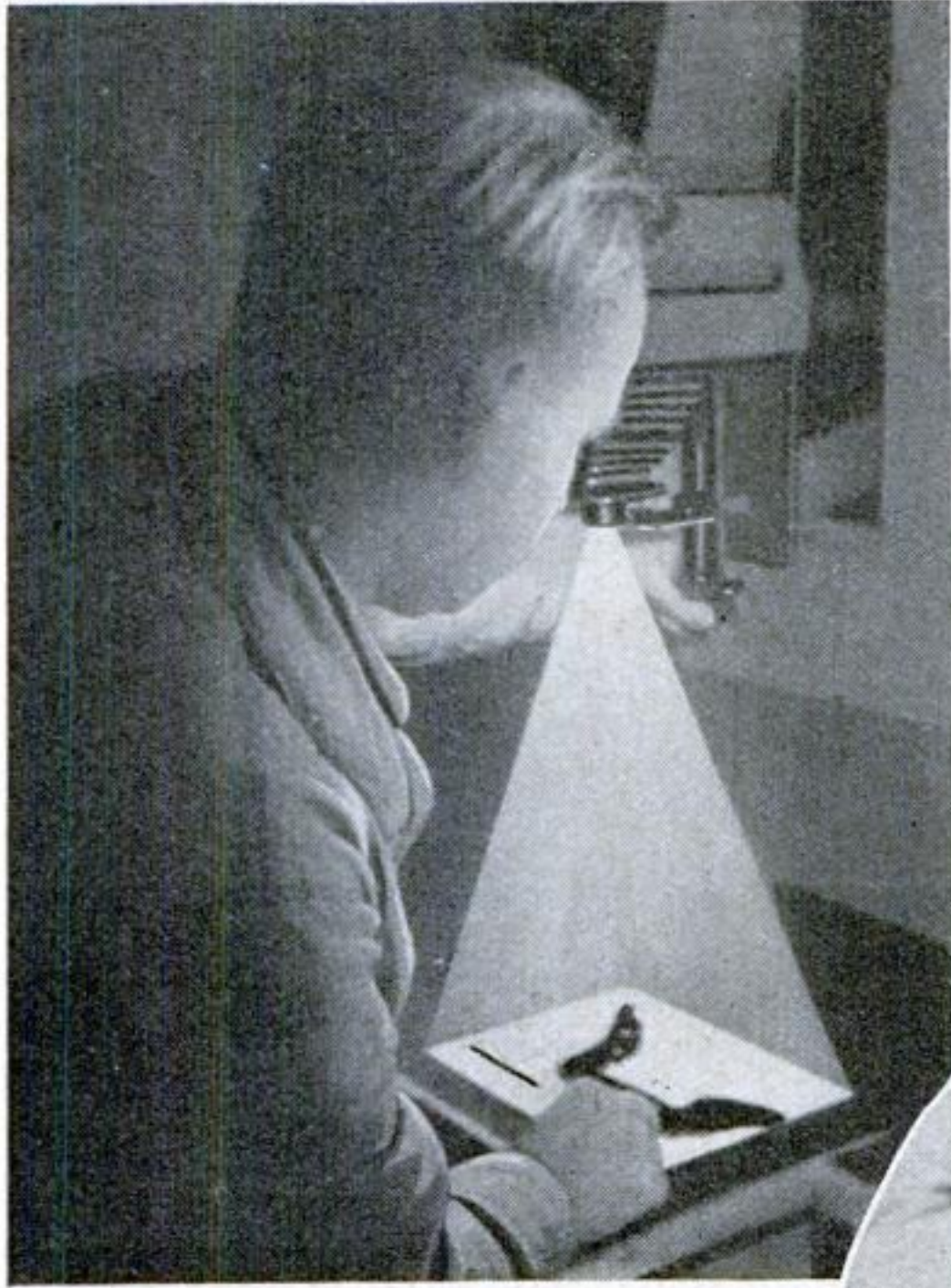
After the disk has been trued by holding a tool against it (a file ground to an edge will serve), it is notched 1/32 in. deep at intervals of about 1/20 in. by using a knife and a lightweight hammer as shown.

Purchase a carat of bortz diamond powder, which is comparatively inexpensive, and mix it with a very small amount of light grease such as petroleum jelly. With a pointed stick, place the mixture on the slits; then close the notches by hammering. This will also make the rim wider, which is necessary to provide clearance.

The mineral specimen to be cut is fastened to a thin board with sealing wax or other cement and fed into the disk. Kerosene and lubricating oil mixed together will serve as a lubricant. Only the lower rim of the disk need run in the oil.



# Photo Enlarger Saves Draftsman's Time



A piece of wire exactly 1 in. long is placed alongside the finished part on the film holder, as at the right. Then, in making the enlargement, the image of the wire may be measured to establish the scale with accuracy, as shown above

IT IS sometimes necessary for draftsmen to measure and dimension small parts that have irregular surfaces. If these surfaces are composed of curves of more than one radius, it is difficult or impossible to break them down into their individual radii.

To provide an easy method of measuring such a part, it can be placed in or on the film holder of a



photographic enlarger and projected onto bromide paper. When this is developed, there is a permanent record of the part, which can be dimensioned accurately at leisure. The enlargements thus made should be dated and filed away to form a check against parts made at a later date.

When duplicate parts have to be made at any future time, they can be checked accurately by placing them in the enlarger and projecting over the original print. Slight errors are then amplified to such an extent as to make them quite conspicuous.

To make a scale for measurement of prints of this type, a piece of 1/16-in. diameter wire, 1 in. long, should be placed in the enlarger close to the specimen. Measuring the length of the image of this piece immediately fixes the amount of magnification of the print, which may, for example, be two to one or four to one.

The utility of this process can be extended to include some small parts that have undercuts. In order to do this, a wax impression of the part is made, and the wax impression is then projected onto the bromide.

Another method of recording profiles of larger pieces is to place them directly upon photo print paper and expose to light.—ROY E. PETERSON.



Squared-up rubber grommets prevent rolling

## Rubber Squares Keep Pipettes on Bench

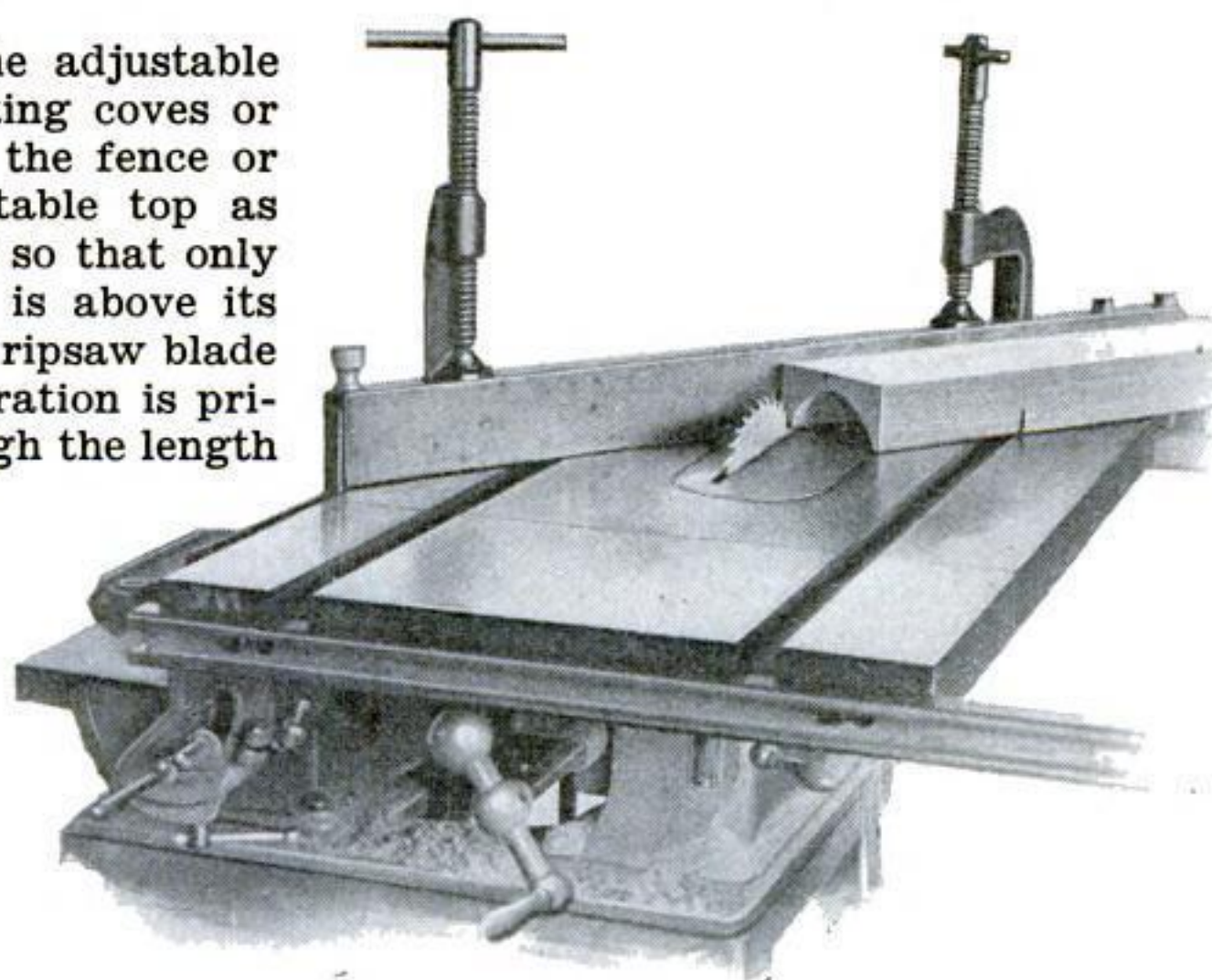
CHEMICAL pipettes, glass battery hydrometers, and similar glassware used in the laboratory or shop, are likely to roll off the bench or table and break on the floor. One of the simplest ways to prevent this is to cut small squares of rubber from ordinary rubber sheeting or to square up some rubber grommets and place them over the ends of the glass tubes or rods as at the left. These will stop all rolling.

## Concave Moldings Cut on a Circular Saw

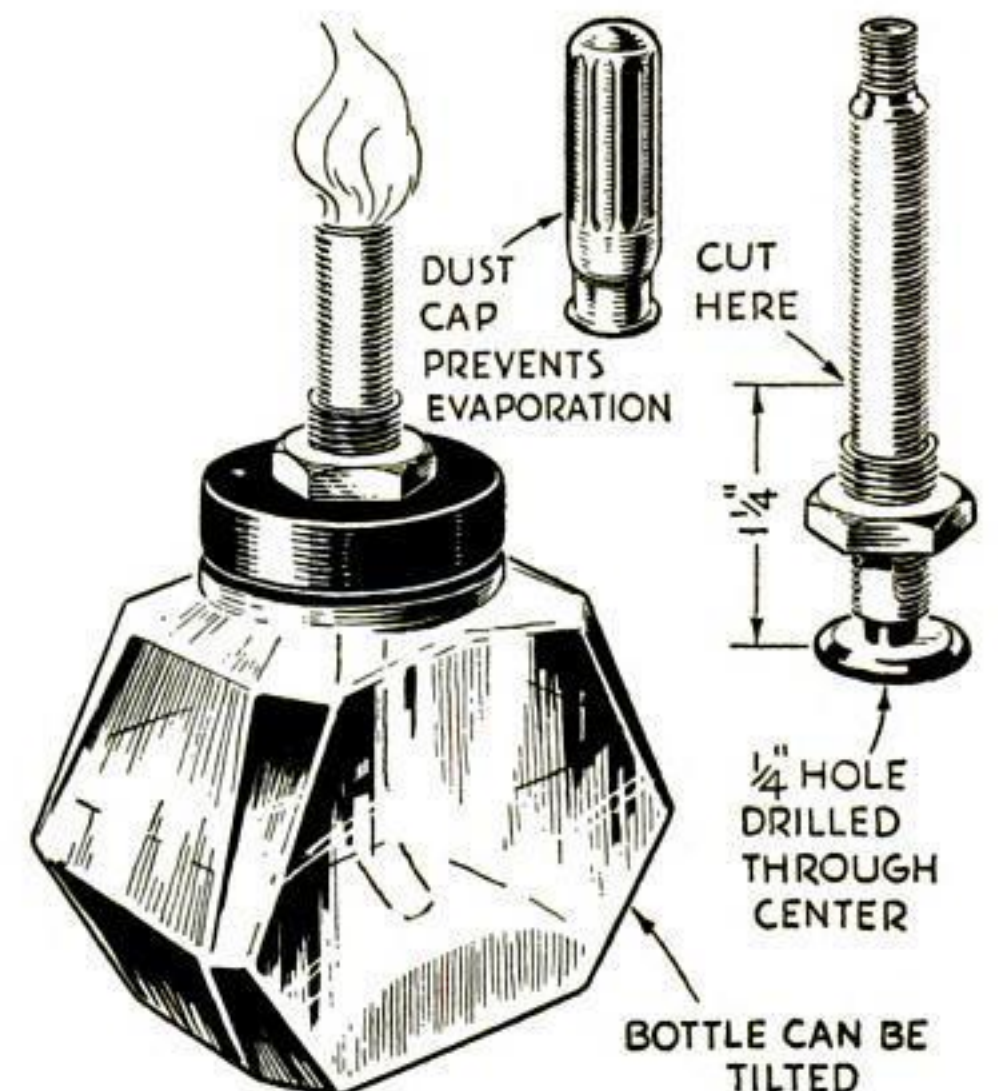
ANY circular saw of the adjustable type may be used for cutting coves or concave moldings. Clamp the fence or guide diagonally to the table top as shown, and raise the table so that only about 1/4 in. of the blade is above its surface. For this purpose a rip saw blade should be used, as the operation is primarily one of ripping through the length of the stock. Push the stock carefully over the saw for the first cut; then drop the table a trifle after each cut. With a little care, a perfect cove can be made.

Sliding the guide around to different angles will enable almost any size cove to be cut out by this simple method.

—WALTER B. BROLIN.



To shape the cove, the blade is raised a trifle after each cut

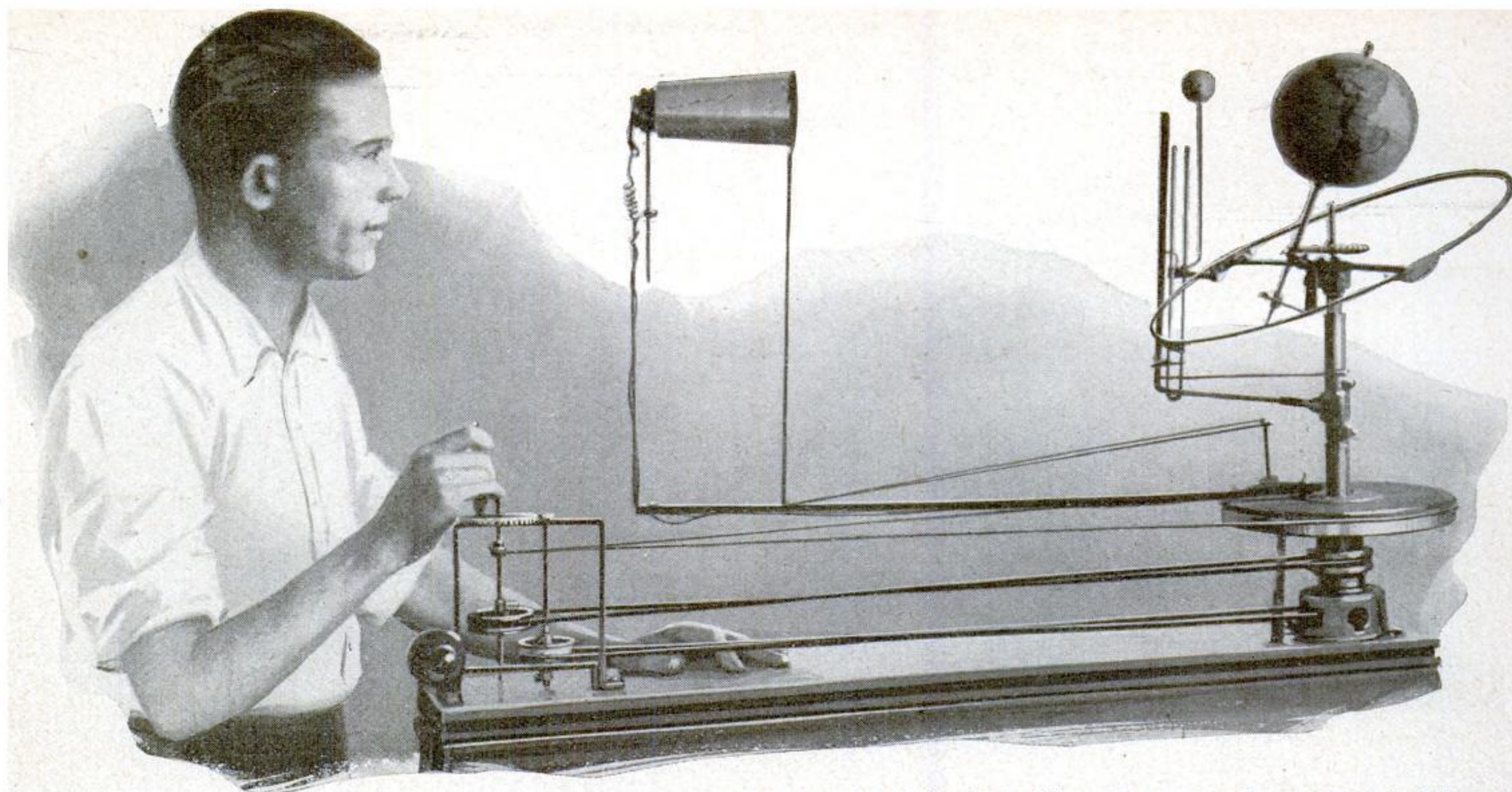


## Tire Valve and Bottle Form an Alcohol Lamp

IN LESS than an hour, a handy little alcohol lamp can be made from a screw-cap ink bottle, an automobile tire valve from an old inner tube, and a piece of wicking.

Remove the nut that holds the valve to the tube. Cut the valve 1 1/4 in. from the flange and drill a 1/4-in. hole through the center of the valve. Make a hole in the ink bottle cap large enough to take the valve. Screw the valve to the cap with the hexagonal nut that is threaded for the dust cap. The cap, when screwed onto the nut, will prevent evaporation of the alcohol. It may also be necessary to drill a very small hole in the bottle cap.—H. M. CHAPPELL.

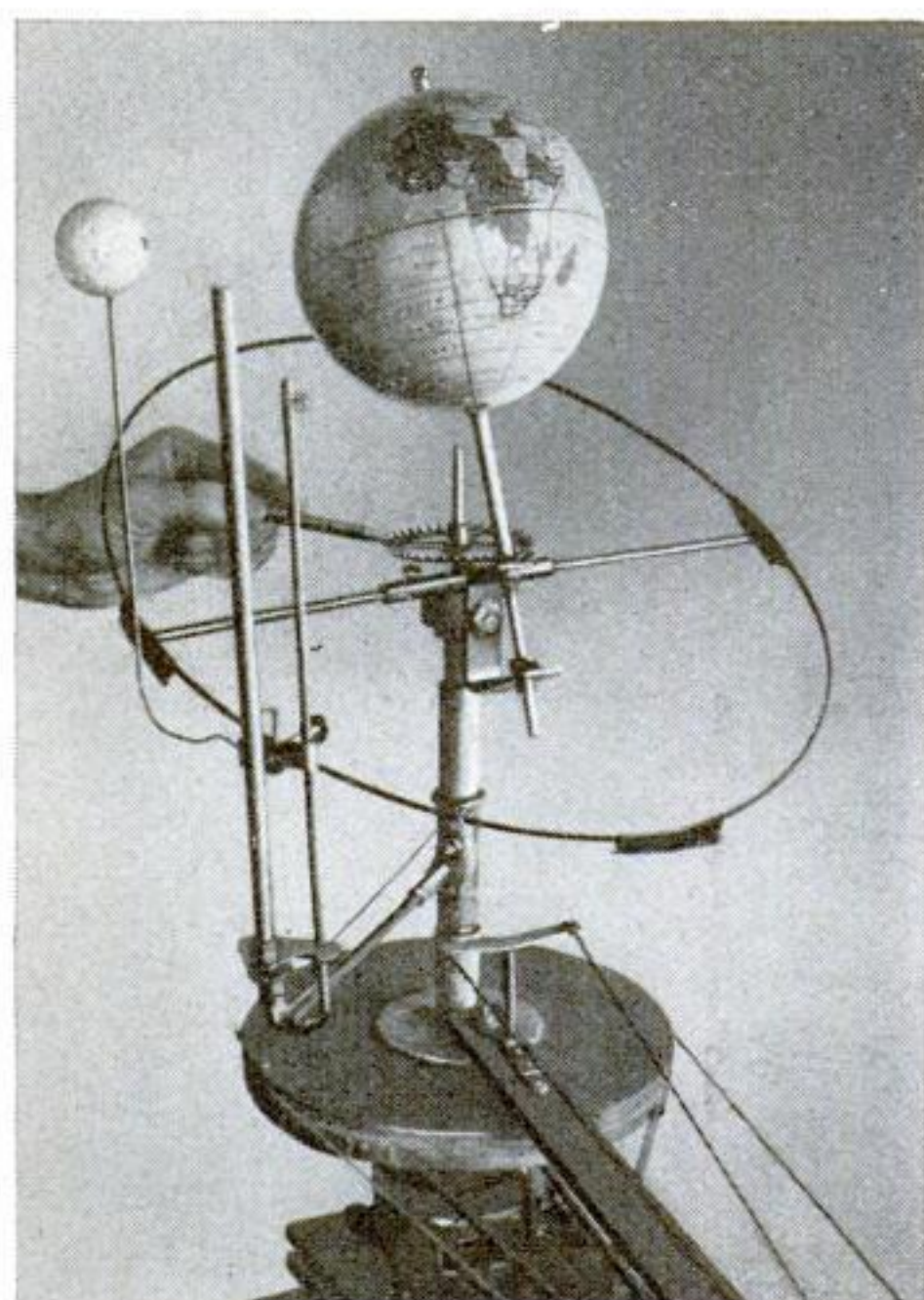




Known as an orrery, this device illustrates many curious astronomical facts

# Earth-and-Moon Model

## MADE FROM ODDS AND ENDS



The egg-beater gear indicated by the pencil is turned by a small pulley at the bottom

BY  
G. E. ROHRER AND  
H. W. ROBINSON

THE fascinating study of the relationship between the earth and moon may be greatly simplified by making a model of the type illustrated. A tin globe 5½ in. in diameter, a number of odds and ends, plenty of solder, and a

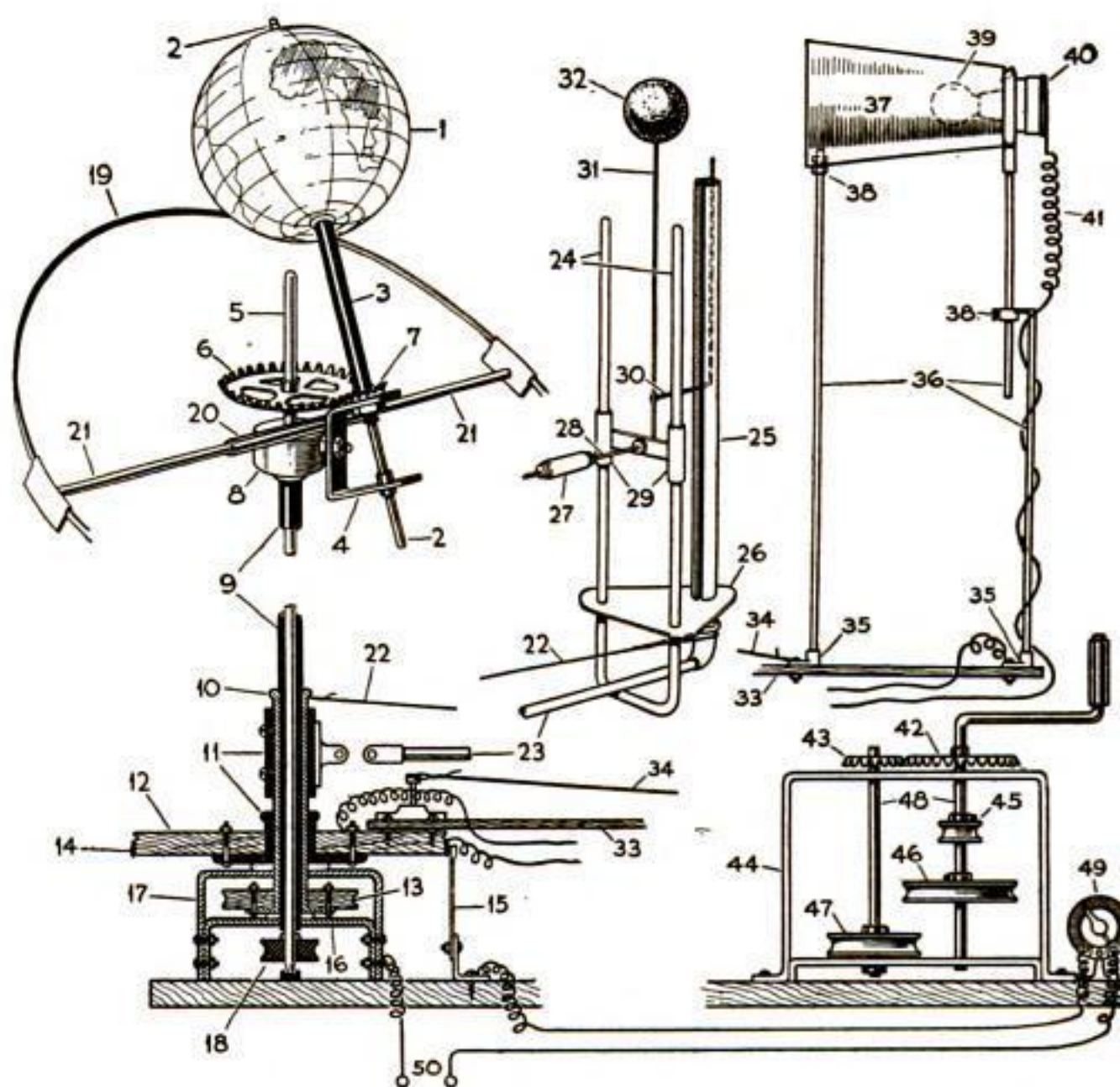
little patience and ingenuity are required. For most of the parts, other materials than those indicated may be used. Regular gears, for example, may be substituted for the gears of an ordinary egg beater, which the authors used.

In the model, which is known as an orrery, the earth rotates 365 times and the moon circles the earth thirteen times as the sun makes one revolution. The cork moon, aluminum painted, is 1⅜ in. in diameter. Based on their sizes, the earth and the moon should be separated more than 16 ft., and the sun should be a huge ball 50 ft. in diameter and more than a mile away, but a generally correct effect is obtained by inclining the orbit of the moon 35 deg., instead of 5 1/7 deg. This inclination, with an 18-volt flash-light bulb to represent the sun, produces the various phases of the moon and eclipses showing the umbra and penumbra in motion.

The cross arms of the moon's orbit, which are two 6-in. pieces of curtain rod, enter a ¼-in. pipe in which set screws enable the entire orbit to be adjusted to any desired angle for various observations.

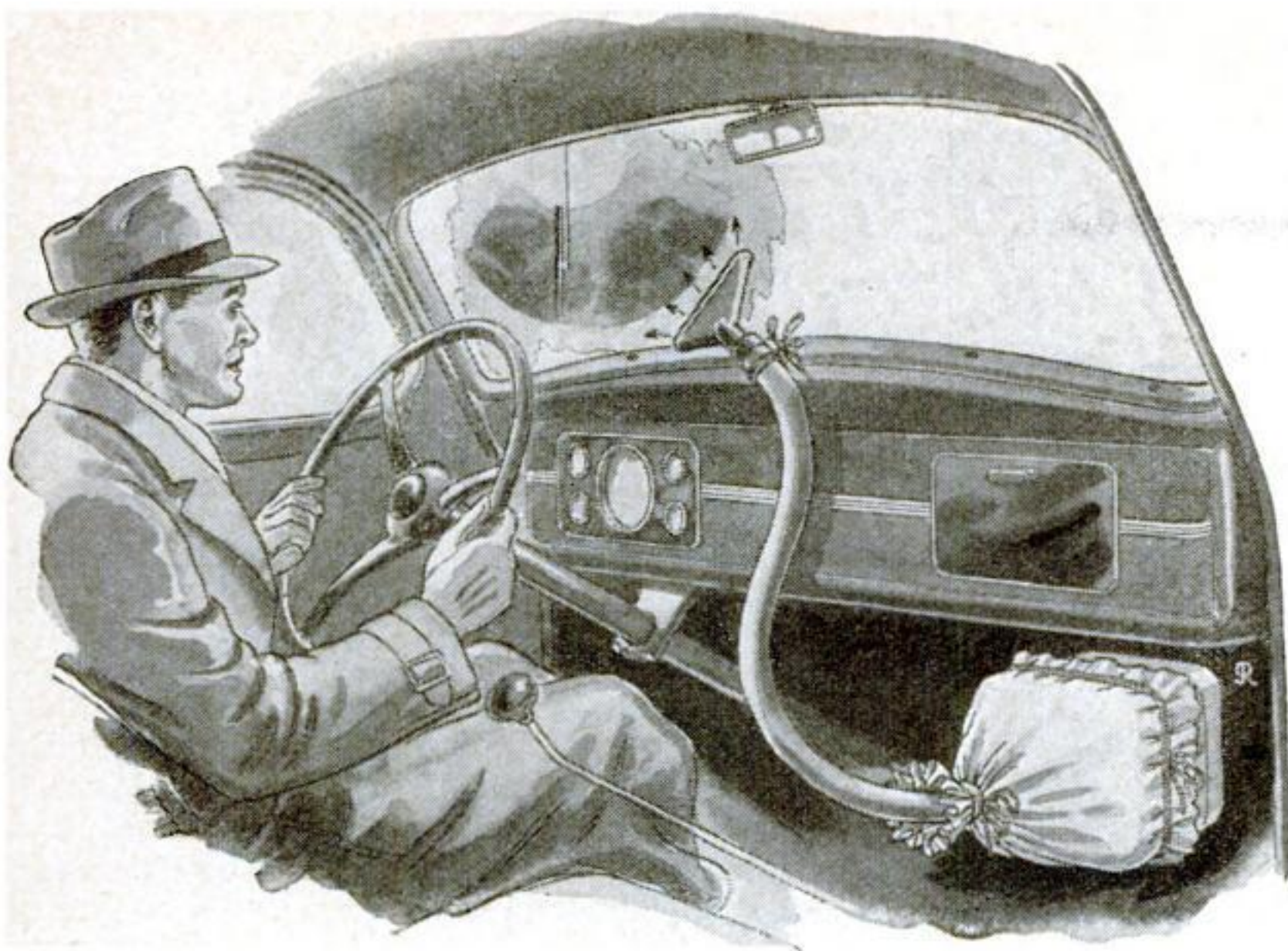
For the base of the

center structure, an electrical fuse box 3 by 3 by 1½ in. is used. A ¼-in. curtain rod, filed to a point, passes through a hole in the center and rests in a small metal cup at the bottom. Just above the point of the rod is attached a 1-in. grooved wheel for a pulley, the belt for which passes through one of the regular openings in the fuse box. The ⅜-in. center pipe (marked 9 in the drawings) through which the rod 5 extends, is threaded into the top of the fuse box. At the top of *(Continued on page 112)*



A key to all the numbers is given at the end of the article





## Cleaner Hose Serves as Defroster

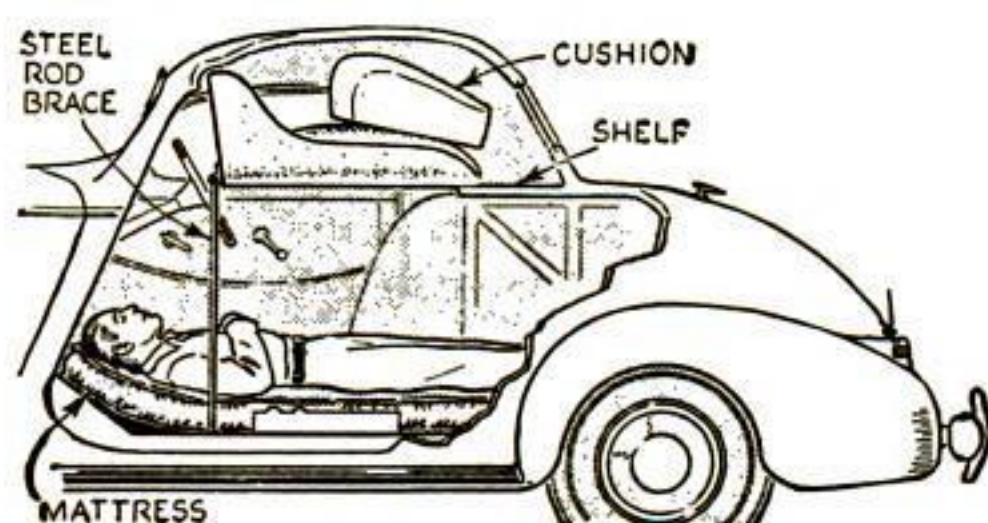
AN EMERGENCY defrosting unit for car windshields can be made with the hose and nozzle of an old vacuum cleaner. Fasten the nozzle near the windshield by clamping the hose to a molding screw above the dash. Tie a heavy brown-paper bag over the car-heater outlet, and run the hose through a hole made in the bottom of the paper bag. Warm air from the heater will pass through the hose and play on the windshield through the nozzle.—S. R.

## Car Top Is Insulated with Aluminum Paint

I WOULD like to pass along a simple kink that I tried out last summer. The inside of my four-year-old coupe always got very hot when the car was parked in the sun for any length of time. Knowing that bright-colored surfaces tend to reflect heat, I applied a coat of aluminum paint to the top and found that it reduced the interior temperature of the car about ten degrees.—M. A. W.

## Coupe Makes Bedroom with Seat Removed

SLEEPING accommodations can be provided in a coupe by removing the seat back and using the rumble or luggage compartment to obtain the necessary length for a mattress. Cut the bottom frame of the seat and weld on projecting lugs so that it can be reassembled. The back frame can then be separated from the bottom, pushed up, and supported near the top of the car on hinged rods, as shown below. When not in use, the mattress can be carried in the luggage compartment.—F. E. L.



Coupe arranged for sleeping, with the seat back raised and a mattress laid on the floor

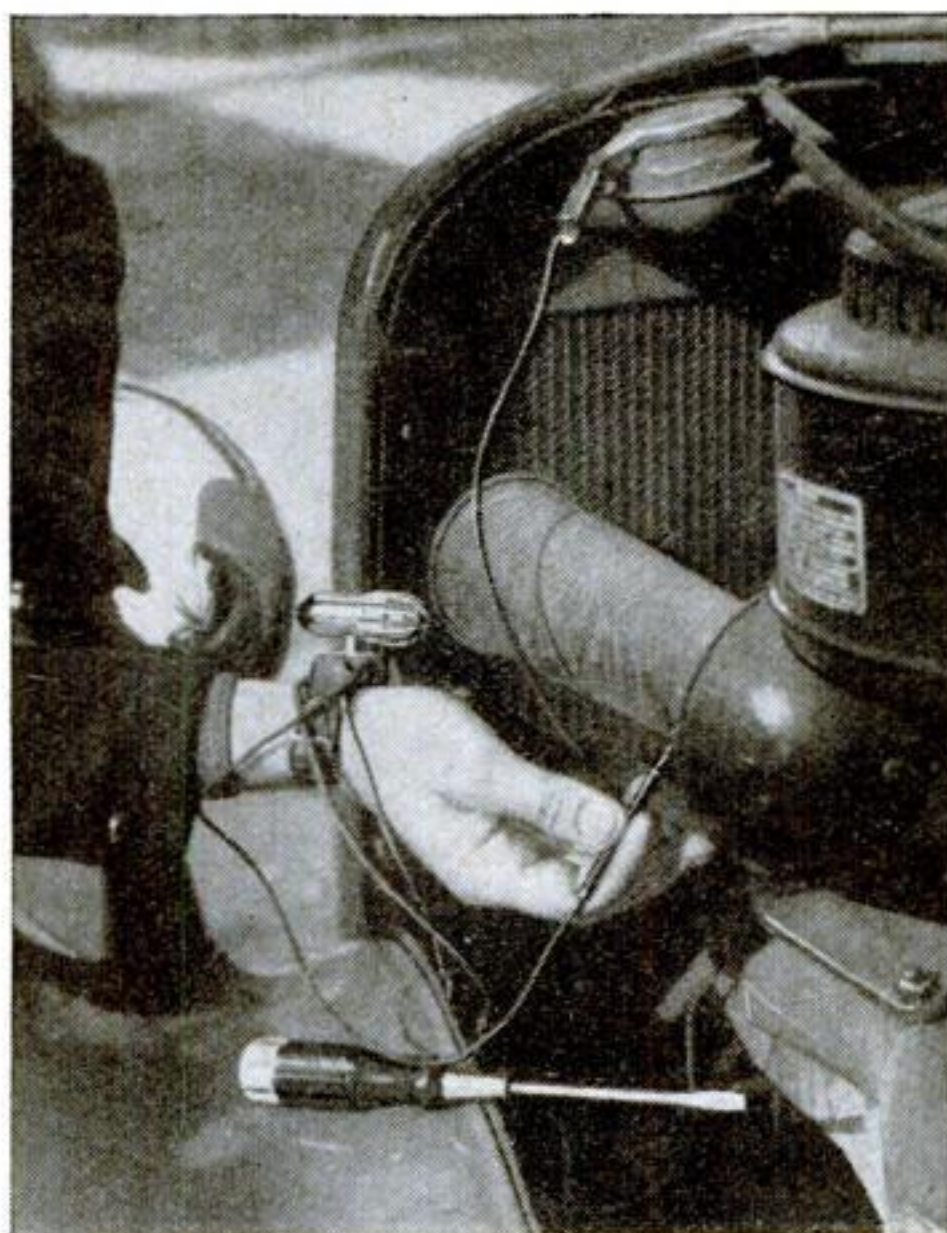
# New Ideas FOR Motorists

## Wax Crayons Lubricate Doors and Windows



COMMON wax crayons, of the type used by school children for drawing or coloring pictures, provide an excellent lubricant for silencing squeaks in various parts of an automobile. The crayon can be applied directly to hinges, latches, and door bumpers, and also to the motor hood. If car windows are hard to raise or lower,

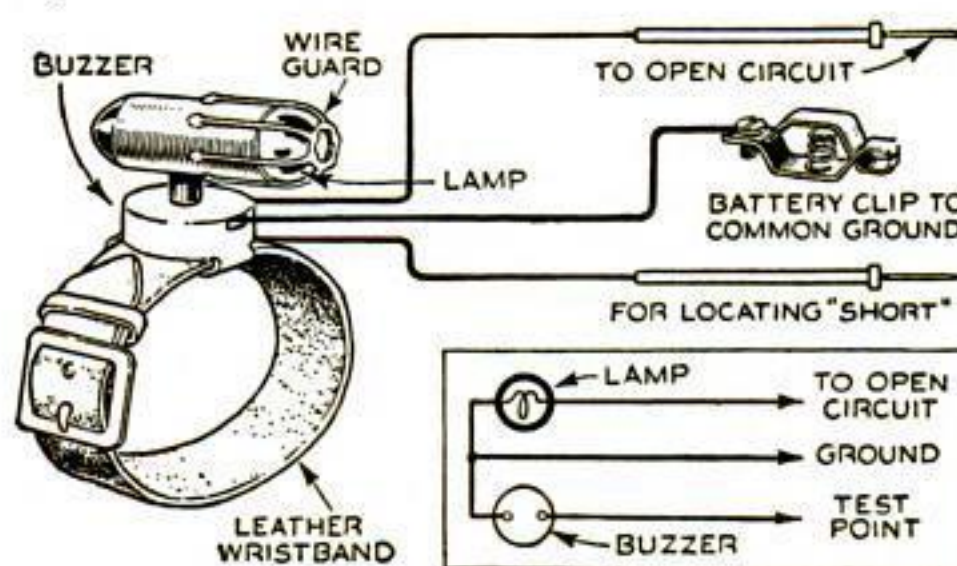
a little of the crayon wax rubbed up and down in the felt window channel will produce a smooth surface and make the glass slide more easily.—A. H. W.



The tester unit in use. The drawing at right shows how light, buzzer, and points are wired

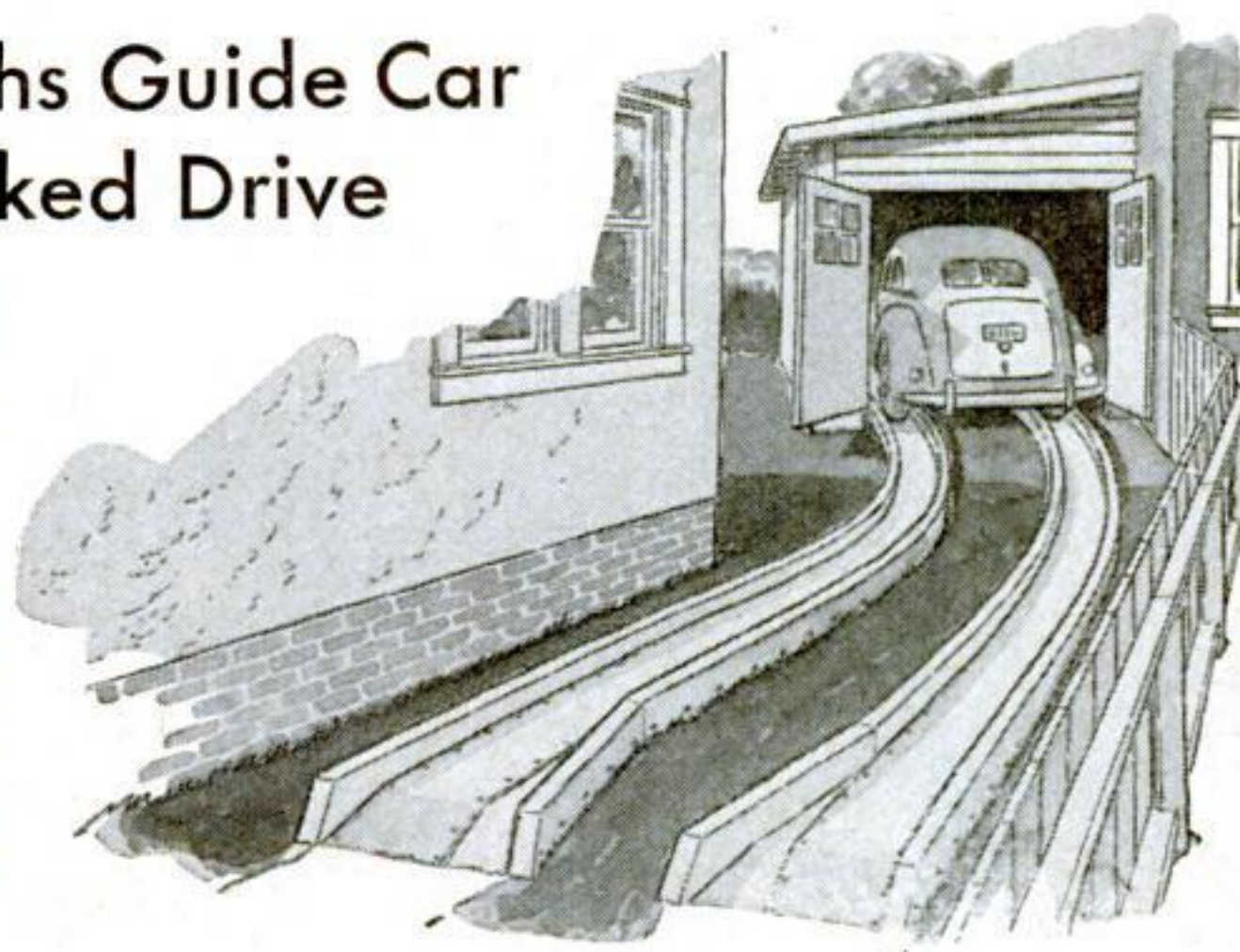
## Tester Worn on Wrist Spots Wiring Trouble

WIRING troubles and loose electrical connections in a car are easy to spot with a novel testing unit worn on the wrist. The device consists of detector points and a testing buzzer for locating short circuits, and a small lamp that is useful for illuminating the parts being checked. The wiring diagram of the unit is shown below.—B. R.



## Wooden Troughs Guide Car Along Crooked Drive

EASILY constructed troughs serve as tracks to guide a car in and out of a narrow, curved garage driveway, preventing scraping or scratching of the car finish or damaging a fender. Made of wood, the tracks guide the car along the center of the drive, once the wheels are engaged between the track uprights, as pictured in the drawing.—B. W.





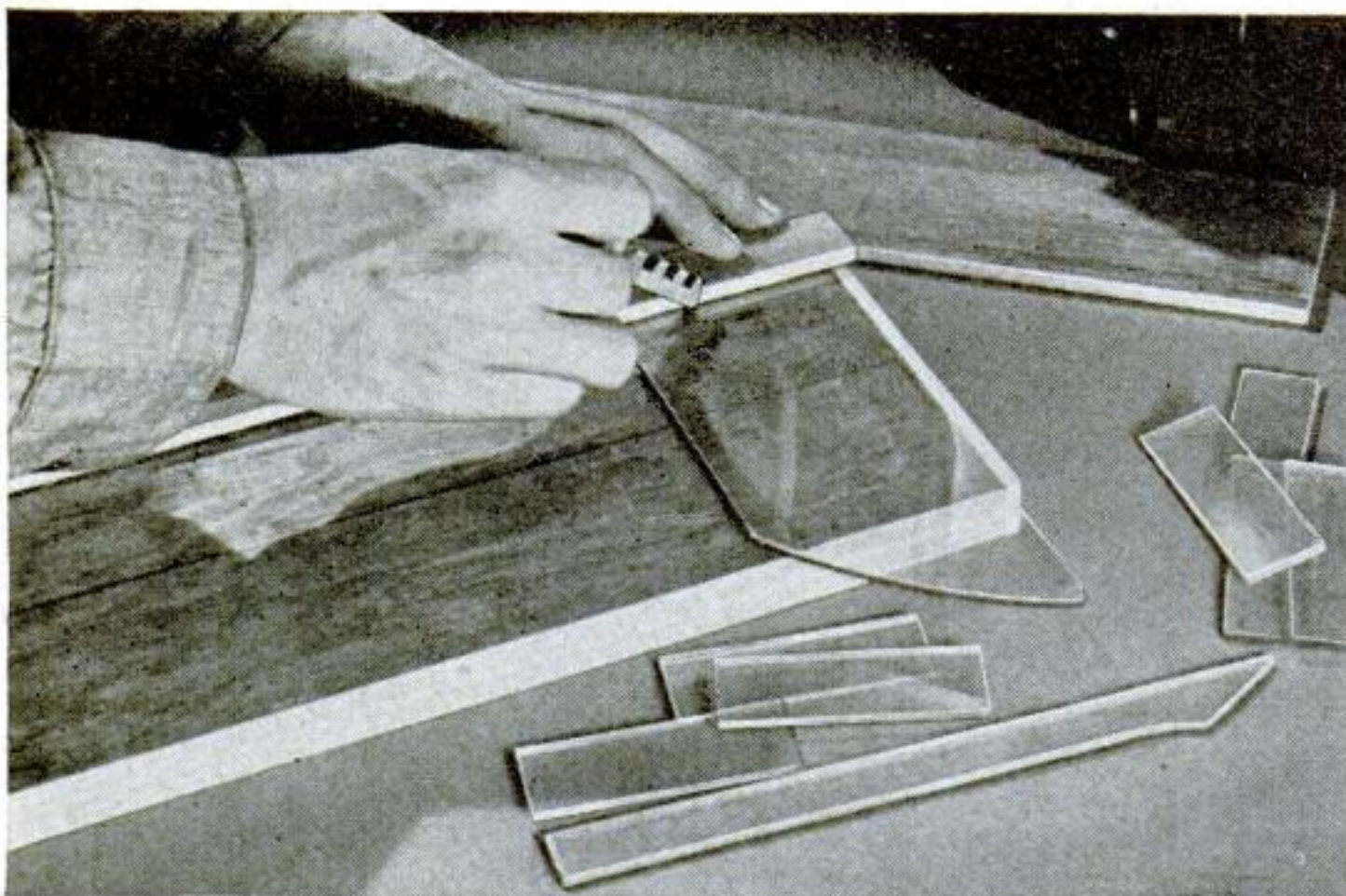
# SHORT CUTS

Here Are Some Ideas That Your Fellow  
Money on Equipment and Supplies, and

By MORTON C. WALLING



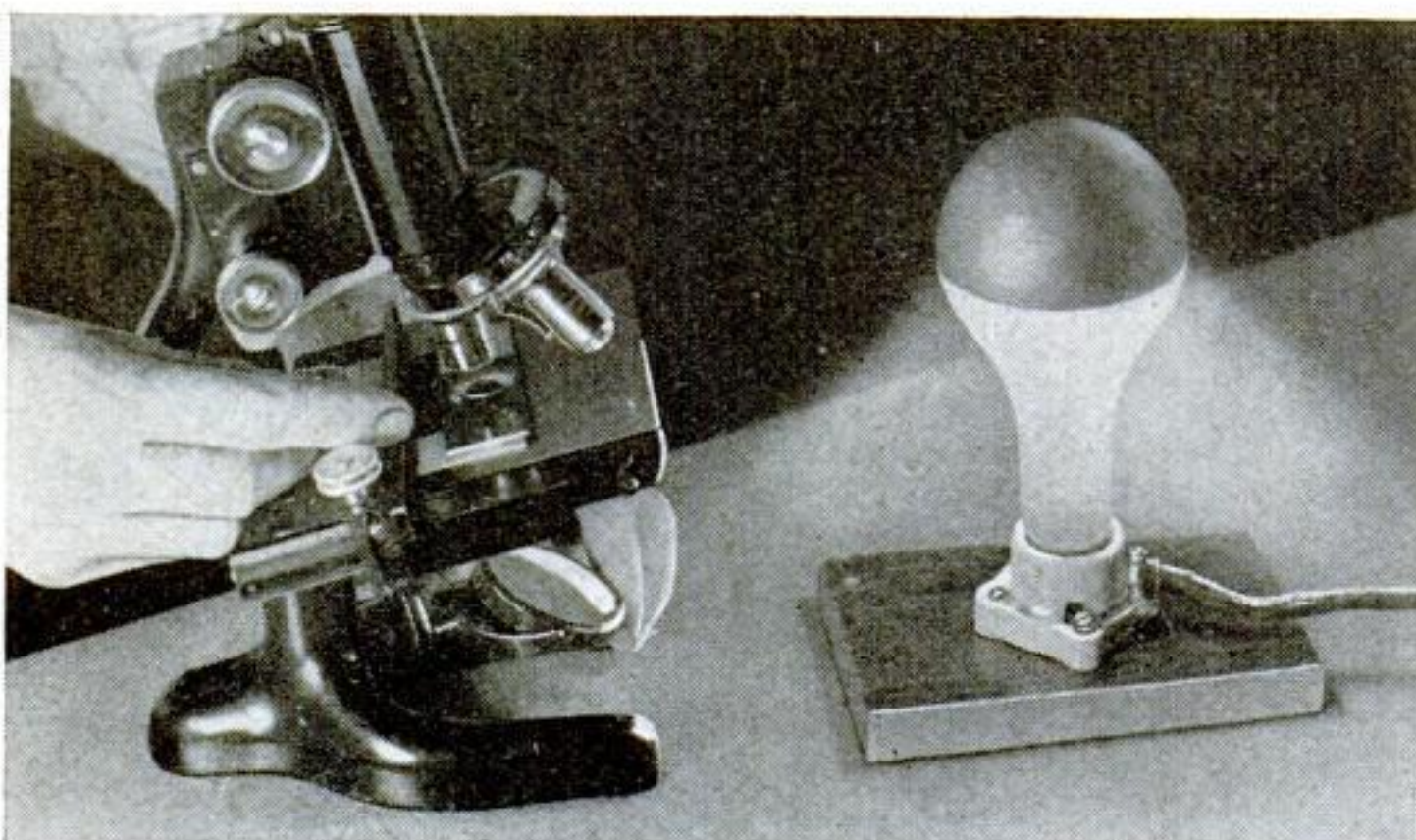
Clear lacquer or varnish is a satisfactory substitute for balsam in mounting many kinds of specimens for examination



With a glass cutter and a homemade jig, you can make your own slides from scraps of single-weight window glass. Details of the jig construction are given in the drawing at the bottom of this page



Very thin cells are made by punching holes in cover glasses. This is done by cementing the cover to a metal strip provided with a hole of the desired size, and breaking through the glass, as above



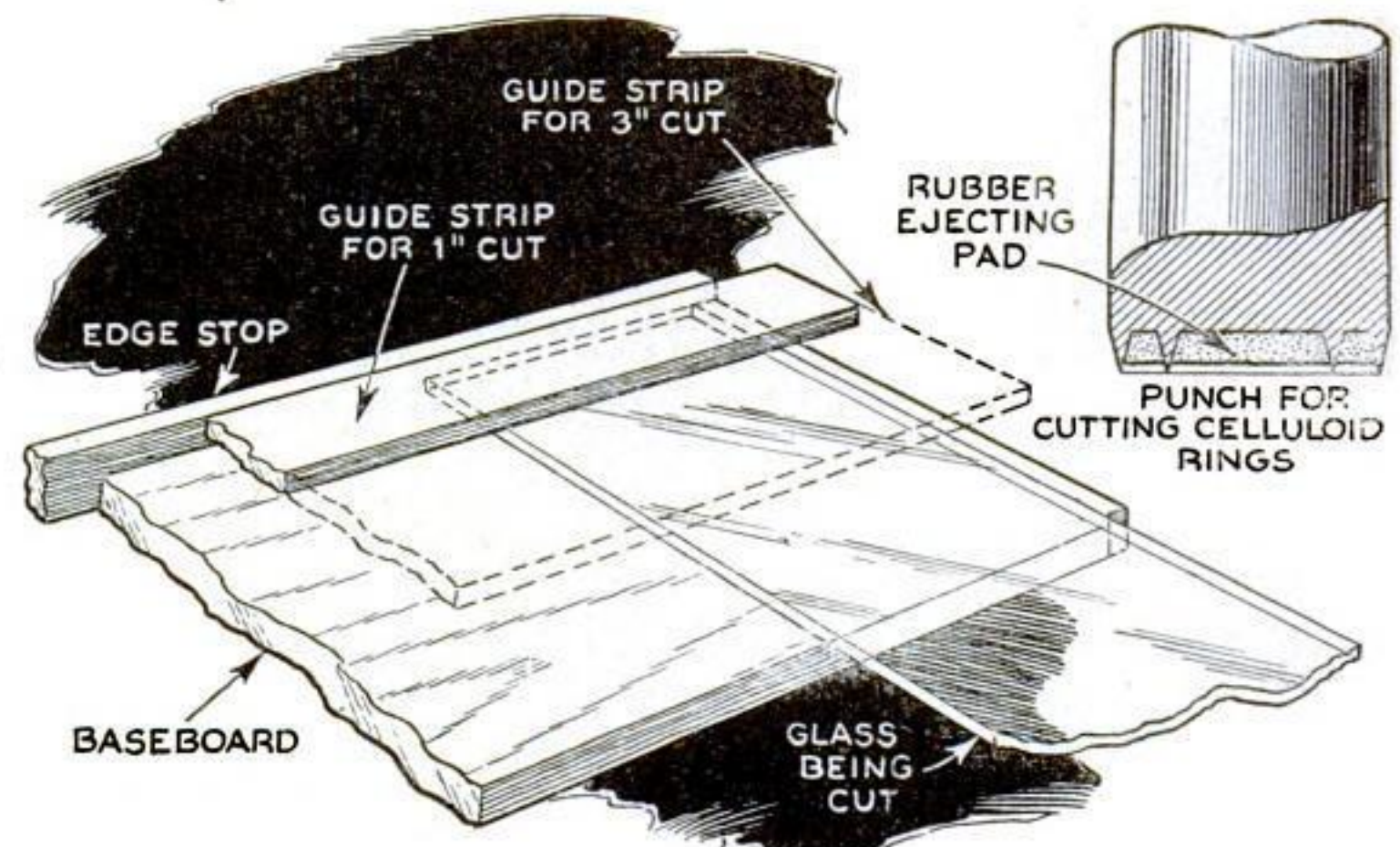
Using one of the new silvered lamps as a microscope illuminator

**W**HETHER by inclination or by necessity, the average microscope hobbyist is an ingenious person. Whenever he can, he employs inexpensive short cuts and timesaving tricks. From junk-box odds and ends he creates needed tools and instruments. With common household articles he reproduces the feats of laboratory technicians. Much of the fun of working with a microscope is in these side-line activities. In the belief that amateurs can profit by knowing what others are doing, I shall describe several short cuts that will not only save money or time but will increase the capabilities of the microscope itself.

Among the absolute necessities in this game of looking at tiny things are the glass slides upon which specimens are mounted. The standard size is 1 by 3 in., although other sizes, particularly larger ones, are employed when necessary. Good-quality manufactured slides cost about a dollar for half a gross. You can make them for yourself, simply by cutting them from scraps of single-weight window glass which the local hardware man probably will give you gladly. Any other flat glass, such as washed-off photographic plates, will do as well.

The trick of making slides is in the cutting. For this you will need a glass cutter (a ten-cent one will do), and a cutting board or jig. Obtain a piece of flat lumber of any convenient size, say  $\frac{3}{4}$  by 12 by 15 in. Along one end nail a strip of wood about  $\frac{1}{16}$  in. thick, and  $\frac{1}{2}$  to 1 in. wide. Along one side nail a similar strip about  $\frac{1}{4}$  in. thick. These serve as stops against which the glass rests; and they must be exactly at right angles to each other. Next cut two wooden strips about  $\frac{1}{4}$  in. thick, as long as the baseboard, and of a width that will permit you to make a mark with the glass cutter exactly 1 and 3 in. respectively from the edge. These strips are cutting guides. Their exact width depends on the final treatment of the slides. If you want to grind the edges smooth on an iron plate charged with wet abrasive powder, you should cut the slides a bit oversize, to allow for grinding. If you do not intend to grind the slides, you can cut them exactly to size and eliminate sharp edges by binding them with gummed paper.

Cover glasses may be an item of considerable expense to the amateur. In some cases, substitutes will serve just as well as the commercial article. For instance, pieces of mica about the thickness of a sheet of typewriter paper can be used. Scrap mica can be obtained from hardware stores that service stoves, from electric shops that repair motors, or from the caps of burned-out fuse plugs. Being laminated in structure, mica can be split to any desired thinness. It is easily





# FOR THE Amateur Microscopist

## Hobbyists Have Found Useful To Save To Increase Their Instruments' Power

cut with a knife or shears. You might experiment, also, with pieces of cellulose film or similar transparent material for covering objects mounted in balsam or other nonliquid mediums.

All microscope subjects are not of extreme thinness. It often is desirable to mount whole insects and the like, for study at low and moderate powers. Even such tiny objects as nematodes are not absolutely lacking in thickness. To provide space for such specimens under cover glasses, it is customary to employ cells. These are simply little chambers built in the centers of standard slides.

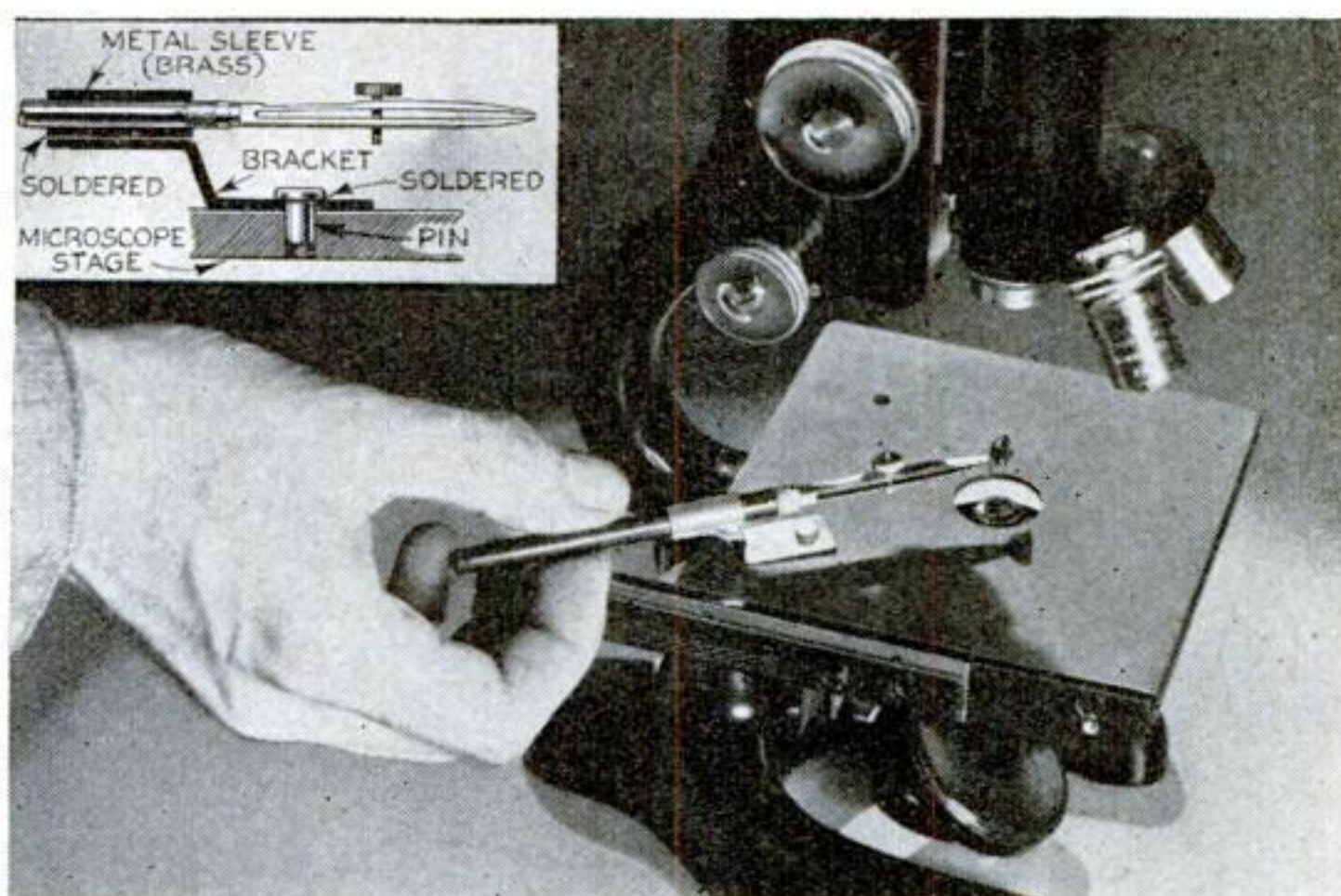
One of the easiest kinds of cells to make consists of a celluloid washer cemented with balsam to the slide. You can cut the washers with a sharp knife, with a pair of sharp-pointed dividers, or with punches. Punches are probably the most convenient. You can purchase in some localities large-size leather punches of various diameters. Obtain one of approximately the same diameter as the cover glass, and one somewhat smaller. Even more convenient is a punch that will cut both inside and outside circles at one blow of the hammer.

If the washers refuse to lie flat after cutting, simply lay them on a sheet of glass and let a drop of acetone flow under them to eat away the thicker parts. Acetone dissolves celluloid, so do not use too much. Gentle pressure can be applied by laying a sheet of glass on the washers, if necessary. When dry, the washers will separate from the glass.

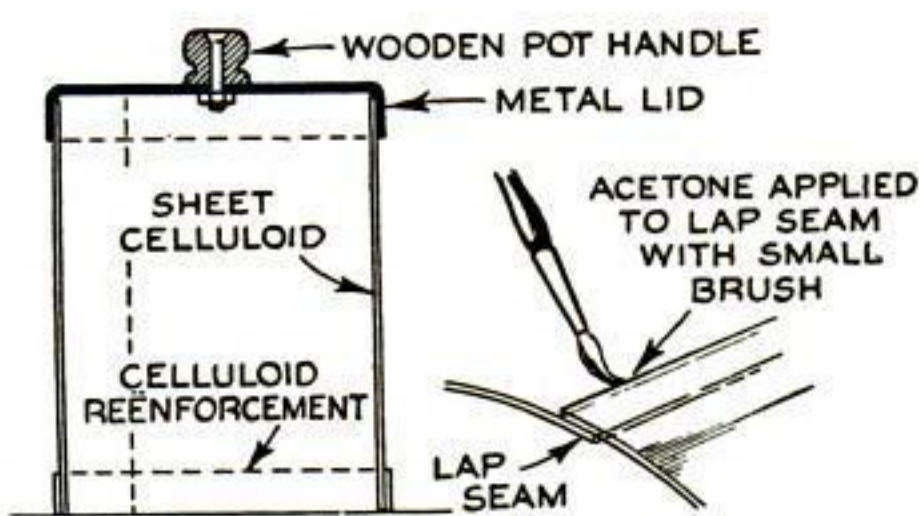
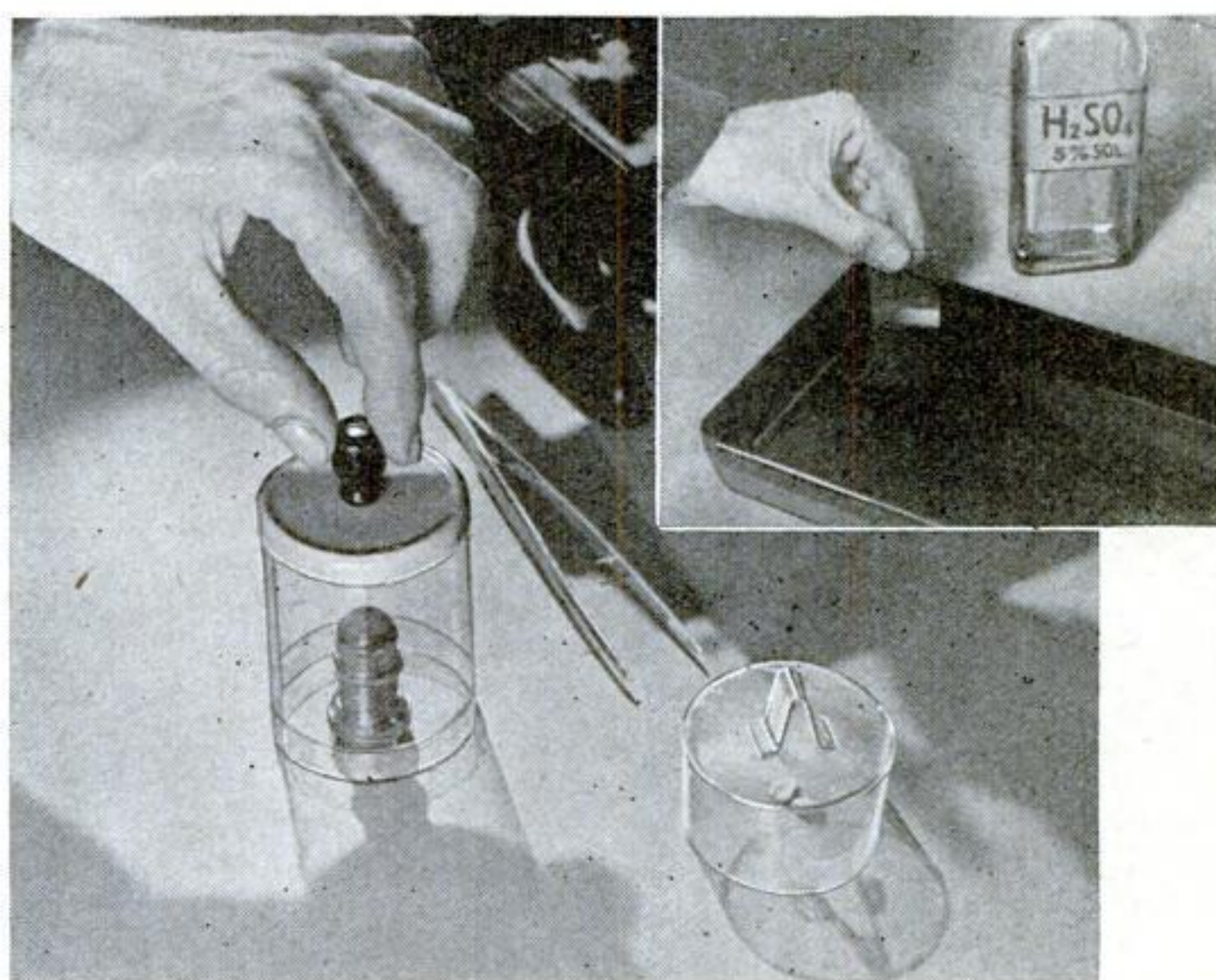
Sometimes it is desirable to use glass washers for making cells. Deep cells are made by drilling holes in pieces of glass of the desired thickness. This is a tedious process involving the use of a brass tube in a drill-press chuck and No. 80 or 100 carbon-silicon abrasive or aluminum oxide, wet with water or turpentine, beneath the tube as a cutting agent.

Very thin cells, however, can be made easily by punching holes in cover glasses. Such glasses are very brittle, and must be handled carefully, especially after being perforated. First drill a hole of the desired size in a flat piece of brass, aluminum, or other metal. Remove any burr from the edges with a file. Heat the metal and coat the area immediately surrounding the hole with sealing wax. While the wax is melted, lay the cover glass on it, centering it with respect to the hole, and let it cool. Now, with a small rat-tail file, you can puncture the glass over the hole, and file it flush with the edges of the metal. Again melt the wax, which was used to keep the glass from breaking beyond the hole, and carefully slide the glass washer off the plate. Remove the wax with alcohol, lacquer thinner, or carbon tetrachloride, which is contained in most fireproof cleaning fluids. Use Canada balsam to cement such cells between slide and cover glass.

If you are caught sometime without your usual balsam or other standard mounting mediums, try clear varnish or lacquer. A. W. Cooper, a POPULAR SCIENCE MONTHLY reader living in Bozeman, Mont., reports that he has had better luck with clear varnish than with balsam for such objects as insect scales, hairs, and pollen grains, because the index of refraction is more favorable. He also finds clear lacquer excellent for general work, and reports that it is much used at Montana State College for algae *(Continued on page 123)*



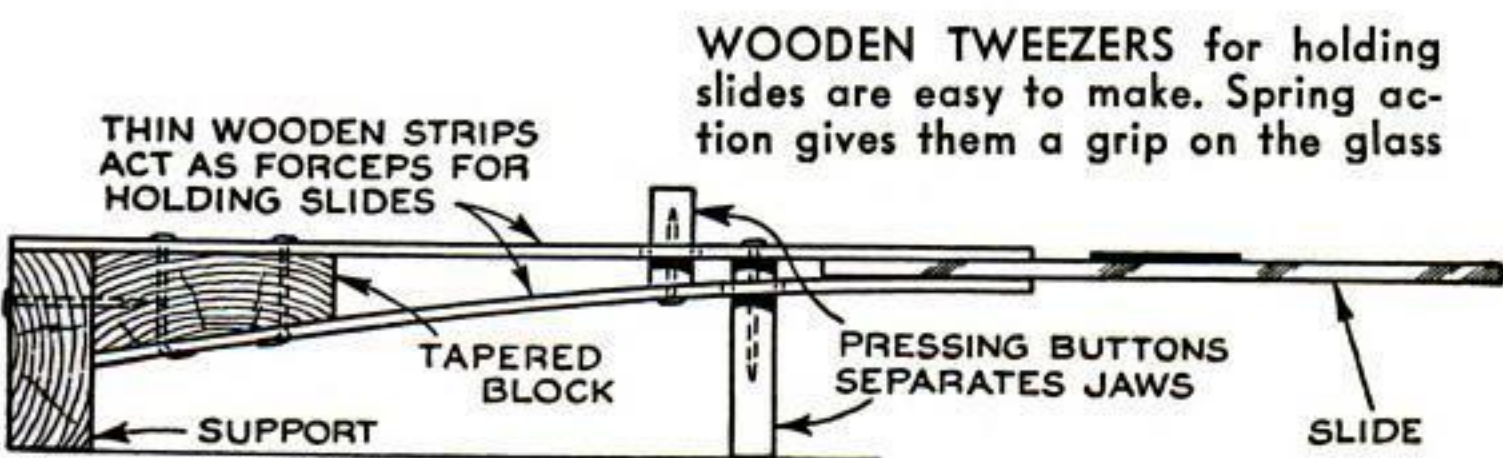
A draftsman's ruling pen mounted on the stage for holding insects under the lens. The easily made holder, illustrated in the sketch, allows a specimen to be rotated or moved back and forth freely



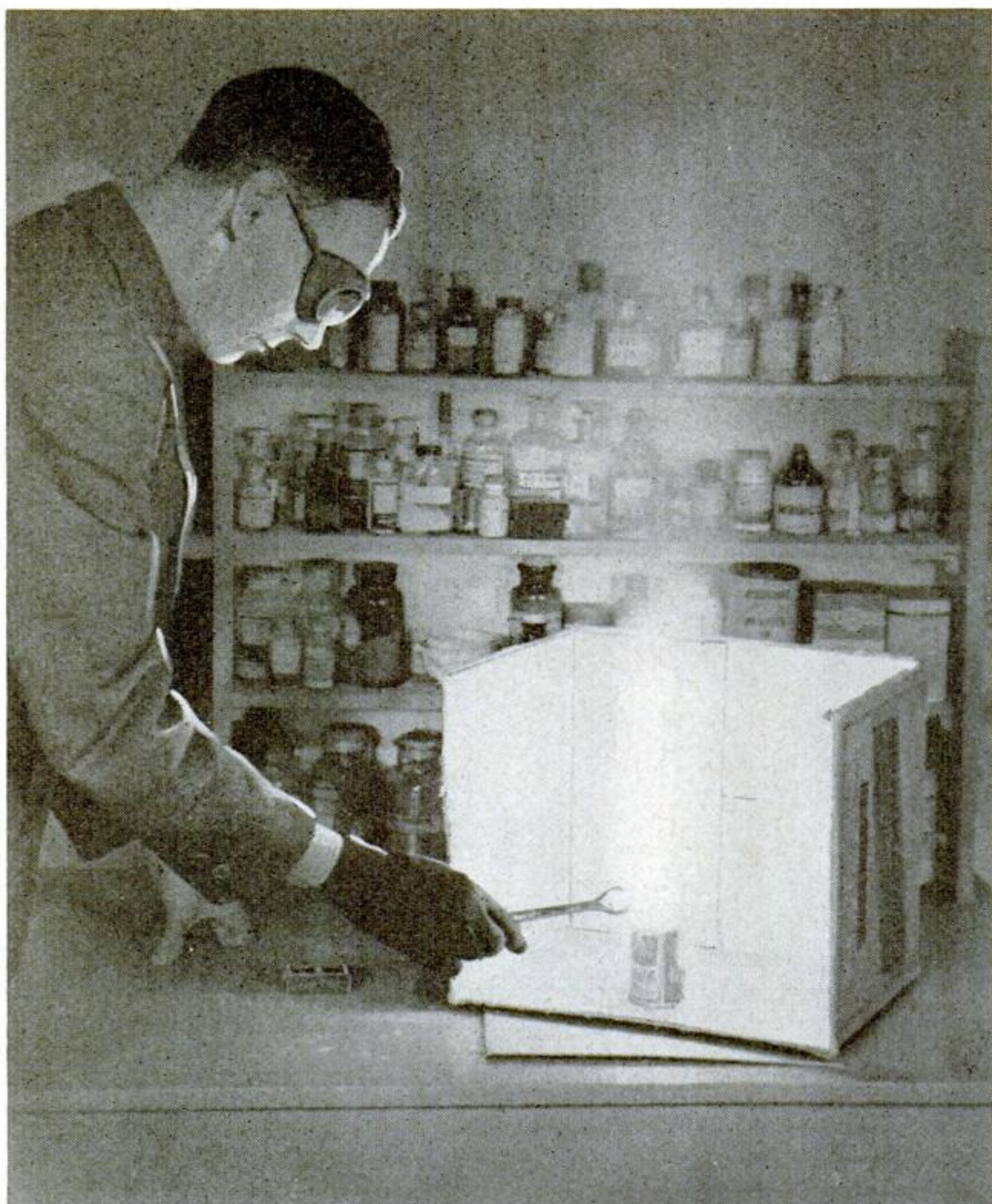
Handy bell jars are made from pieces of celluloid joined together with acetone. Inset shows how photographic film can be stripped of gelatin for use in this way



The bullseye lens from an ordinary flash light will serve as a substage condenser if mounted under the stage as pictured above







Manganese dioxide and aluminum react with terrific heat when they are ignited

**W**HEN you began experimenting with your first toy magnet, you soon discovered that it picked up some things and did not attract others. Scraps of paper, copper and silver coins, bits of string and wood and glass, wouldn't stick to the horseshoe bar at all. But nails, needles, and anything else made of iron or steel readily responded to the magnet's pull.

Are iron and steel the only magnetic materials? So you might have thought, after trying out your toy magnet on all the things you could find around the house. Actually, however, the interesting family of magnetic chemicals has a number of other members that you can discover with the aid of your home laboratory.

Perhaps one of the bottles on your laboratory shelf contains some compound of nickel or cobalt. Heating almost any one of them with a blow-pipe on a charcoal block, together with some sodium carbonate, will liberate the pure nickel or cobalt metal. Try it, and apply a magnet when the fused mass has cooled. Particles of nickel or cobalt will cling to it and can be lifted out, showing that these two metals, like iron, are magnetic. In fact, an alloy of them is more magnetic than iron itself, and they are used together with other metals in some of the most powerful permanent magnets ever made.

An even more curious group of magnetic materials was discovered in the

early 1900's by Conrad Heusler, a chemist who made them by alloying manganese with various other metals. The strange thing about them is that not one of their ingredients is magnetic by itself. Only when the metals are combined does this property appear. You can prepare for yourself one of the Heusler alloys, as they are known, from the metals manganese and antimony.

First you will need to obtain the manganese—a metal that you may never have seen in the pure state, although it plays a vital role, in industry and in war, for hardening certain types of steel. Extracting it from manganese dioxide, or from a mineral called pyrolusite which has the same composition, will make a fascinating and spectacular experiment in itself. In demonstrating the power of chemistry to unlock the treasures of nature, you will command a temperature of more than 5,000 degrees F. to wrest the metal from its ore.

The fiery reaction

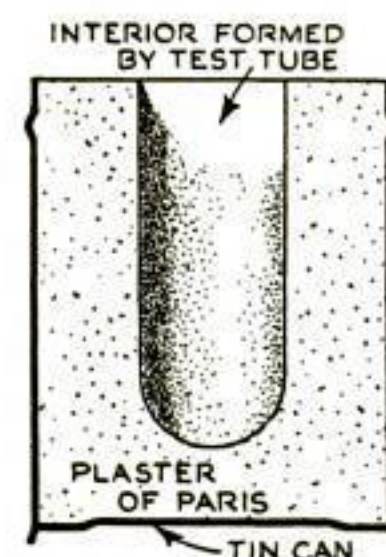
# Fun With

NOT ONLY IRON AND STEEL ARE  
SUBJECT TO ATTRACTION, THESE  
UNUSUAL EXPERIMENTS REVEAL

By  
RAYMOND B. WAILES

## A HOMEMADE CRUCIBLE

Plaster-of-Paris batter, allowed to harden in a tin can, makes a heat-resisting crucible for use in the reaction at the left



you will use was developed by a German chemist named Goldschmidt, who found that manganese dioxide and aluminum will react with terrific heat when a mixture of them is ignited. Oxygen from the manganese compound is torn away by the aluminum, forming aluminum oxide and leaving the pure manganese metal.

A heat-resisting crucible is required for this experiment, and you can easily make a small one of plaster of Paris that will serve nicely. Simply fill a small tin can with a batter of the plaster, and insert a test tube to form a cavity while the plaster is setting.

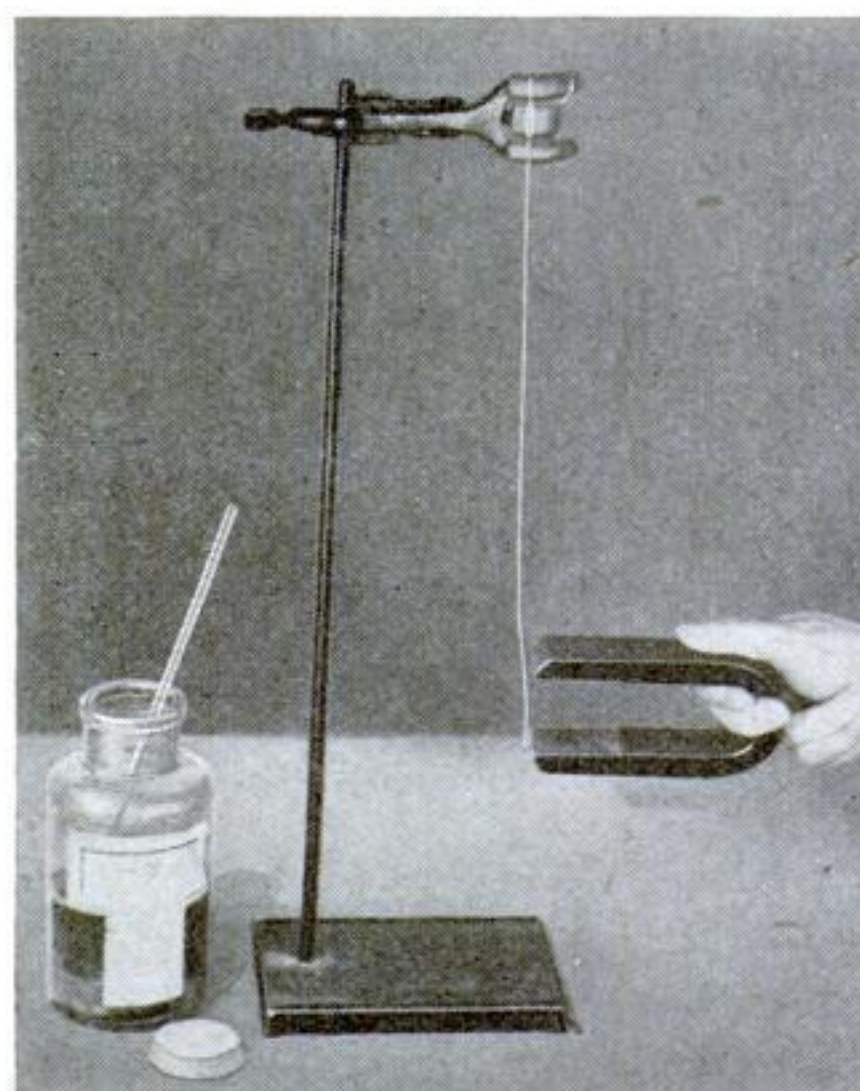
This homemade crucible should be dried overnight in a warm place before use.

As a preliminary step to extracting the manganese, place thirty grams (one ounce) of pyrolusite or of powdered manganese dioxide in a tin-can lid and heat it for half an hour. Let it cool. Then mix it with about twice its volume of powdered aluminum, or "aluminum bronze," of the kind that paint stores sell.

Fill the crucible with the aluminum-

manganese dioxide mixture, and insert a strip of magnesium ribbon in the top of the mixture, to ignite it. Then light the magnesium ribbon with several matches held together in a pair of pliers or crucible tongs. If the powder is balky about igniting, let it cool. Then substitute for the magnesium ribbon a "starting mixture" of charcoal, sulphur, and potassium nitrate, and light it again.

Once the contents of the crucible take fire, the can becomes a seething inferno of flame. At



A drop of ferric chloride solution, suspended on a thread, is visibly attracted by a magnet



# Magnetic Chemicals

the end of the display, you may find the manganese metal in the form of glowing drops or a molten pool, so intense is the heat developed. Despite the fireworks that occur, however, the experiment is perfectly safe if you observe reasonable precautions. Wearing an old glove when you light the mixture, and protecting your eyes with goggles, will remove even the slightest danger from flying sparks; and a carton or other improvised shield will help to keep them from scattering over your chemical bench.

When the reaction is over, and the slag of aluminum oxide has cooled, you will be able to pick the bits of manganese metal from it. You will find, incidentally, that the aluminum oxide slag is hard enough to scratch glass. Grinding wheels are made from it.

You can prove that the metal you have made is manganese by placing a few particles in a test tube, covering them with an inch or so of water, and heating the tube. The metal will actively react with the water, liberating hydrogen gas and forming a residue of manganese oxide. In this be-

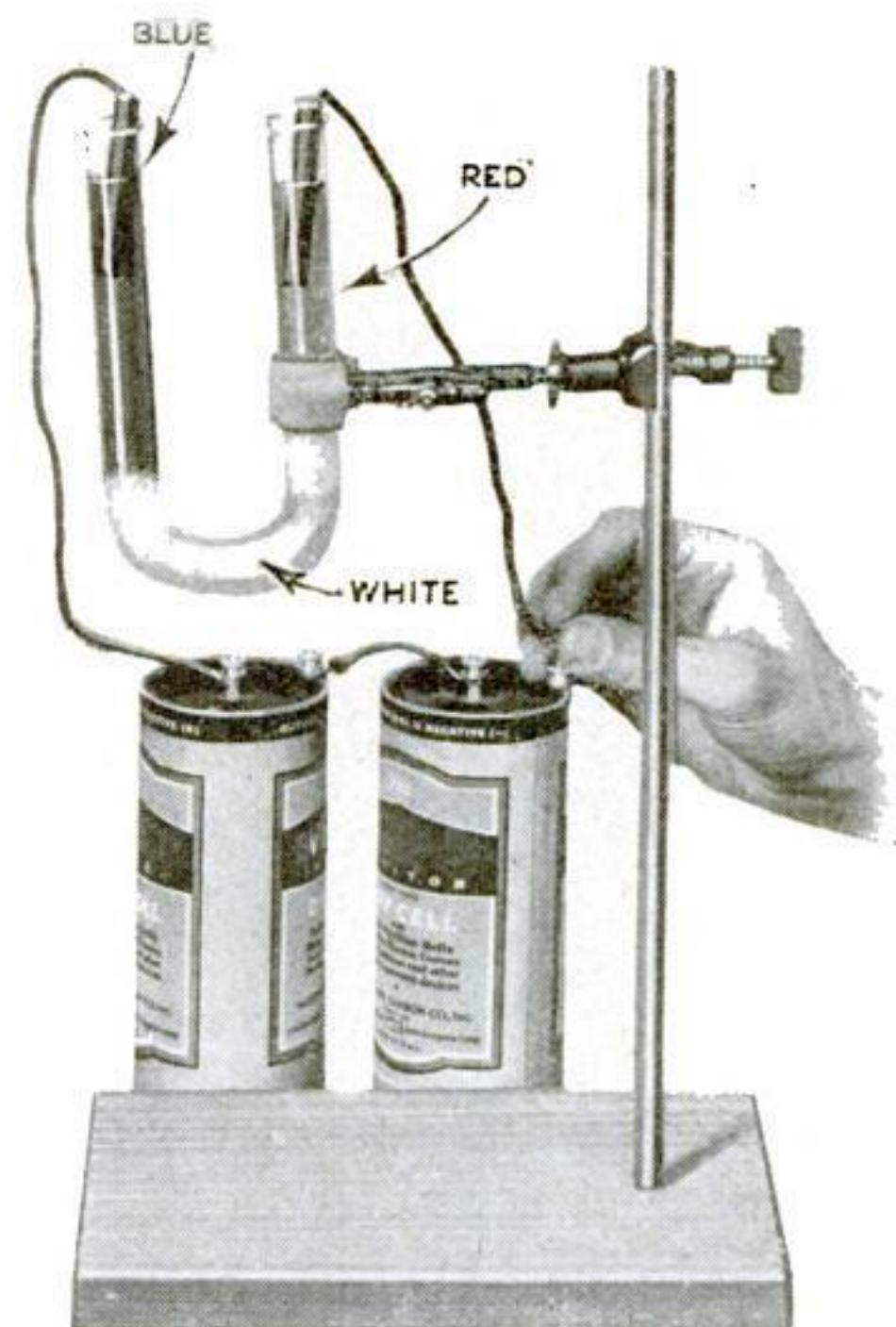
havior it resembles metallic sodium or potassium, though the interaction of manganese with water is considerably less vigorous.

To make the magnetic Heusler alloy, place some of a mixture of powdered manganese metal and antimony in a hard-glass test tube and heat it over a Bunsen burner. A soft-glass tube, which has a low melting point, will not do for this purpose; nor will a wide-mouthed vessel such as a crucible, which will allow the antimony to volatilize before it combines with the manganese.

Break the fused mass from the test tube when it has cooled. If your experiment has been successful, you will find that particles of the material are attracted by a strong permanent magnet. The product is a definite chemical compound, known by the name of manganese antimonide.

Even liquids may be magnetic. This may surprise you, but you can easily prove it to your own satisfaction.

Crystals of ferric (iron) chloride usually become sirupy when kept for some time in their container. They gradually *(Continued on page 129)*



This patriotic electrochemical experiment produces a red, white, and blue display that will prove mystifying to any onlooker

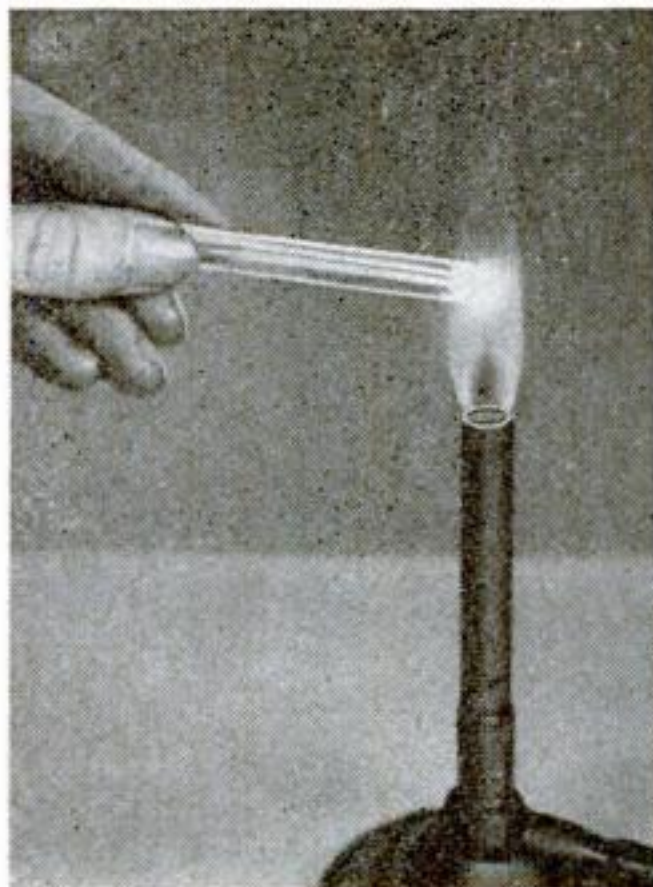
## Blow Yourself to a Tiny Chemical Flask

**M**AKING a miniature Florence flask offers an entertaining exercise in glass-blowing. First, hold the end of a piece of glass tubing in the flame of your Bunsen burner, constantly rotating it while the glass softens. Heat only the very tip, so that the tube will not be distorted, and so that molten glass will not fall away. With proper manipulation, you will obtain a small swelling of molten glass at the end of the tube.

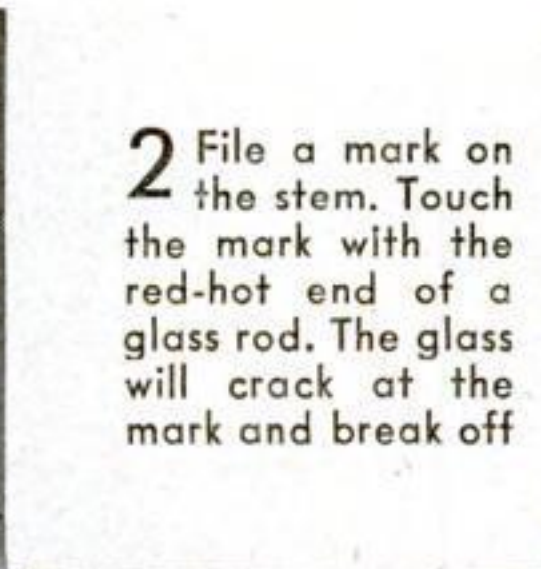
Now, still rotating the tube with your fingers, bring its cool end to your mouth and blow gently into it.

The red-hot end will be enlarged into a bulb. Reheat the end of the bulb in the flame, while you continue to rotate the tube. When the glass is soft, press the bulb against a charcoal block to form a flat bottom.

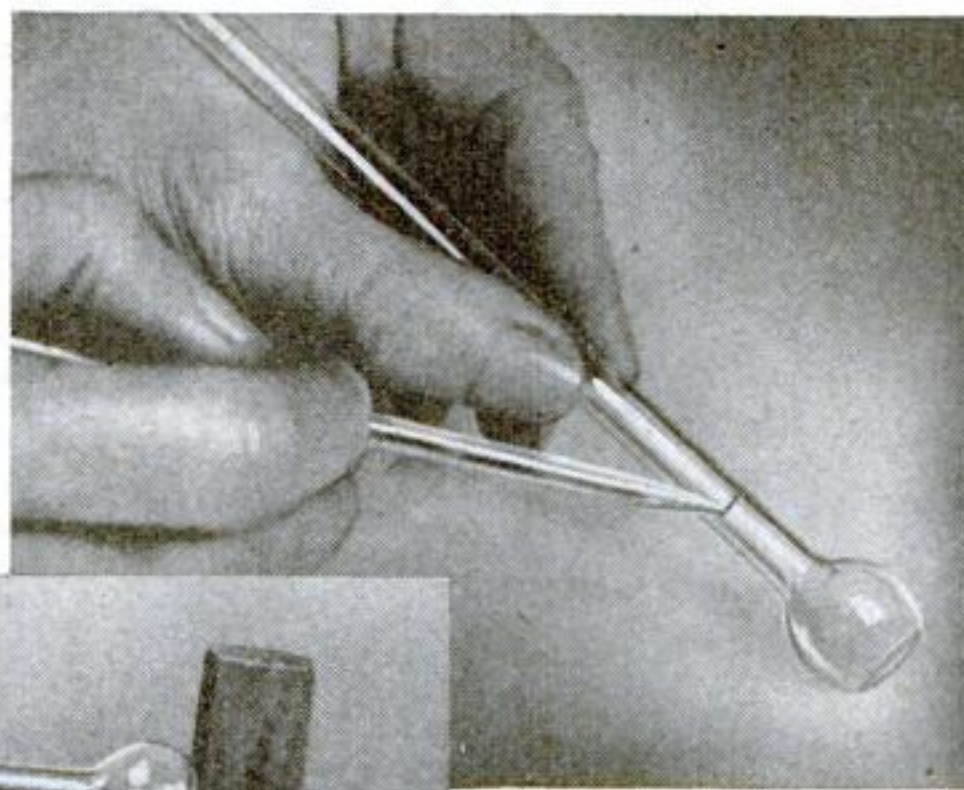
File a mark on the stem of the tube, which forms the neck of the flask. Touch the file mark with the red-hot end of a glass rod, and the tube will crack at the mark. Finally, flare the end of the flask's neck and fire-polish it, by heating it red-hot in the Bunsen-burner flame and inserting a pointed battery carbon.



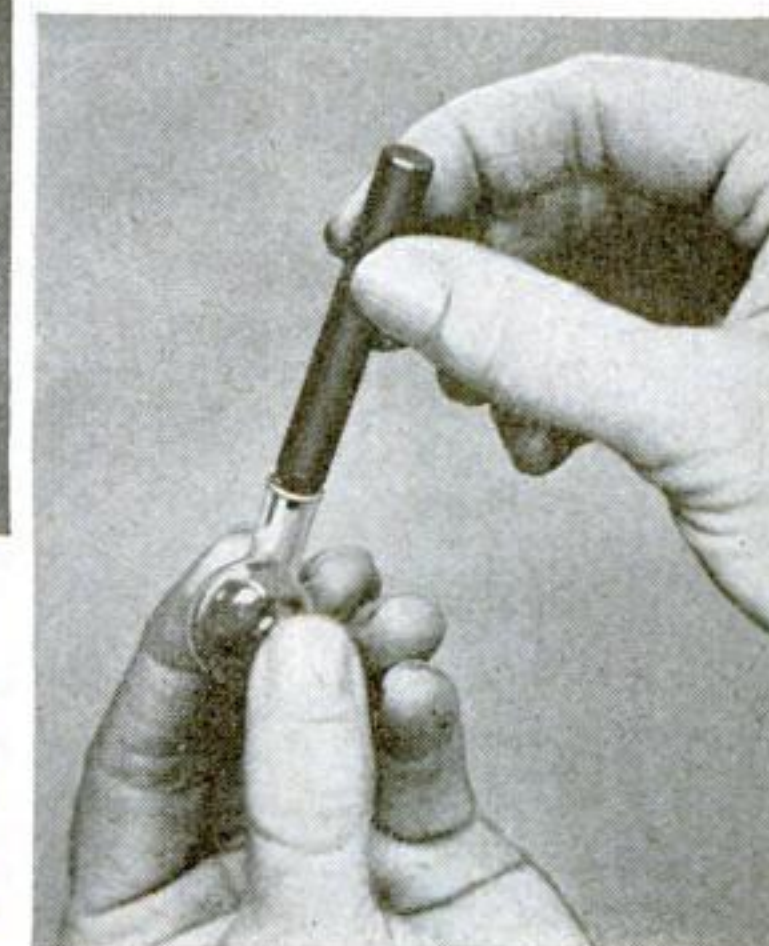
1 Soften the end of a glass tube in a Bunsen flame and blow it to form a bulb. Flatten the bulb against a charcoal block as at right



2 File a mark on the stem. Touch the mark with the red-hot end of a glass rod. The glass will crack at the mark and break off



3 Flare the end of the tube and fire-polish it by heating it red-hot and inserting a battery-carbon tip



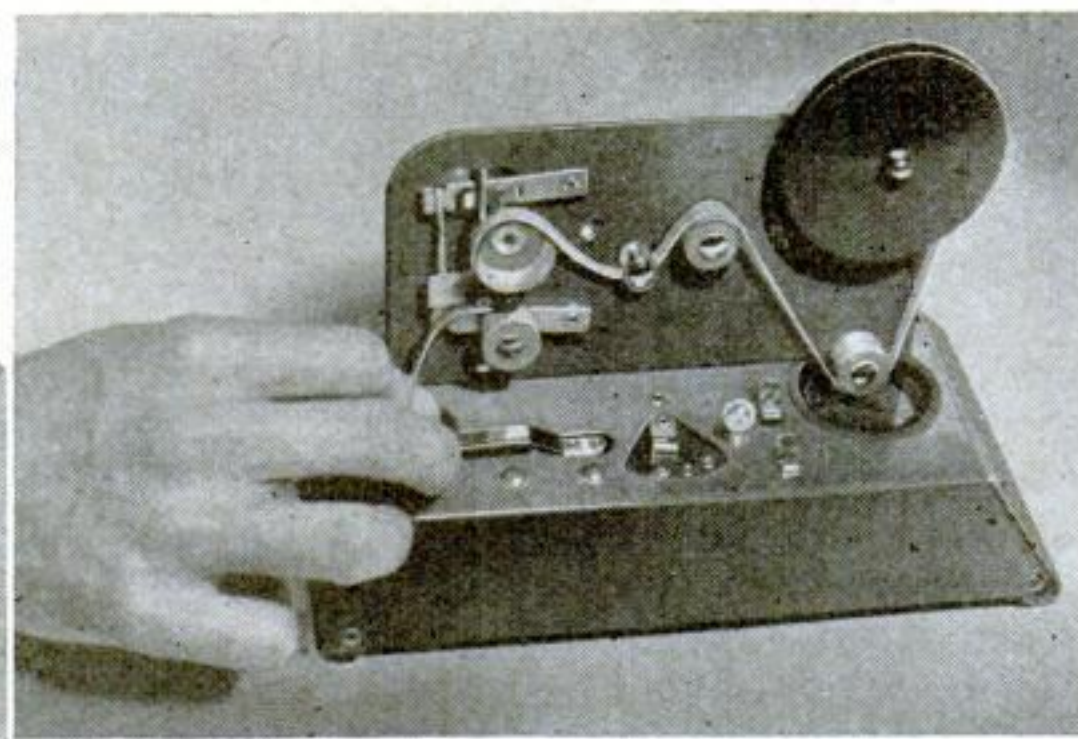
In blowing glass, it is important to rotate the tube constantly



# Timely Hints for Radio Fans



Because the code-practice outfit records each message it is ideal for beginners

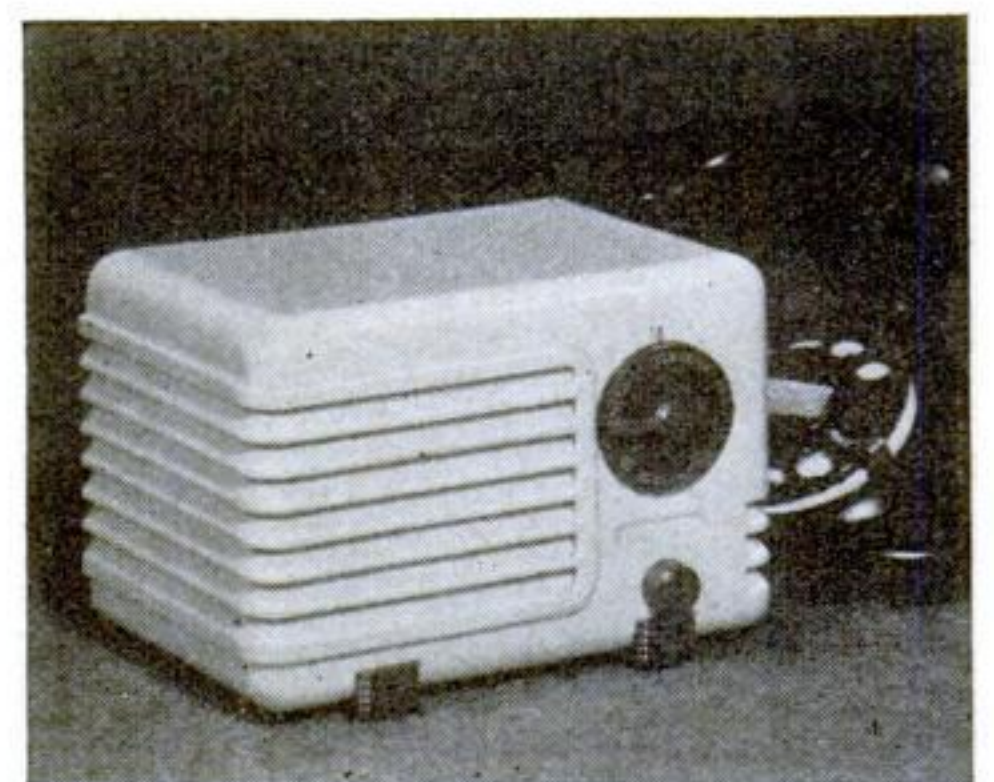


Pressing the key marks dots and dashes on the tape

**D**OTS and dashes are marked on a moving tape in a new inexpensive code-practice device. A chemically treated paper tape passes through a well of water and moves onto a metal drum rotated by a spring-operated motor. Pressing the key sends electric current from built-in batteries through a metal stylus which is in contact with the wet paper, thereby causing a chemical reaction in the tape and producing a change in color to indicate the dots and dashes. Either a buzzer or a blinker light can be made to operate when the device is in use.

## Small Four-Tube Radio Has Dynamic Speaker

**WEIGHING** only six pounds, a diminutive radio that is little larger than an ordinary French-type telephone is now available for the person who wants an efficient receiver in as compact a unit as possible. Housed in a decorative cabinet made of a composition material, the tiny set has a three-inch dynamic speaker and operates on either alternating or direct current. The midget set employs four metal tubes and has a range covering police transmitters as well as the standard broadcast band.



This set is little larger than a phone

## Glass Recording Disks Will Not Warp

**DURABILITY** and high fidelity are claimed for a new warpproof record blank made of glass. Designed for home use, the disk is provided with a special surface finish which can be hardened chemically after a recording has been made. Two special fast-drying fluids, applied with cotton or a soft brush, make the record ready for playing. The disk is said to have an extremely wide frequency response and sufficient durability for at least 200 playings.



Applying the hardening chemicals with cotton

## Electric Phonograph Has Space for Radio

**SO THAT** a radio may be placed on top to form a compact unit, the turntable of a new electric phonograph slides out as the front panel of the cabinet is opened. When the record has been started, the panel can be closed. The output circuit of the receiver serves as the pick-up amplifier.

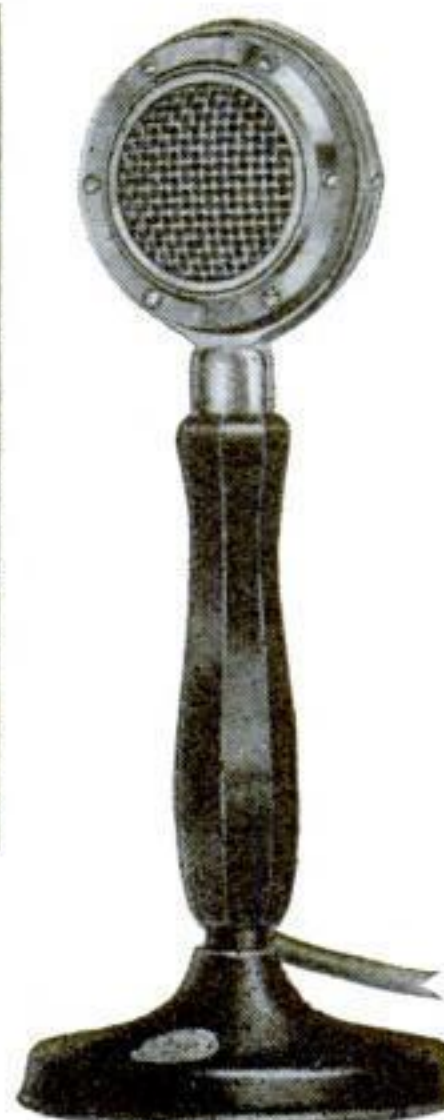
## New Midget Rheostat



**AVAILABLE** in resistances up to 1,000 ohms, a new wafer rheostat measuring only  $1\frac{1}{8}$  inch in diameter and projecting only  $\frac{9}{32}$  of an inch from its mounting surface is designed for the radio amateur.



The novel base transforms the hand microphone into a desk unit as shown in the picture at the right

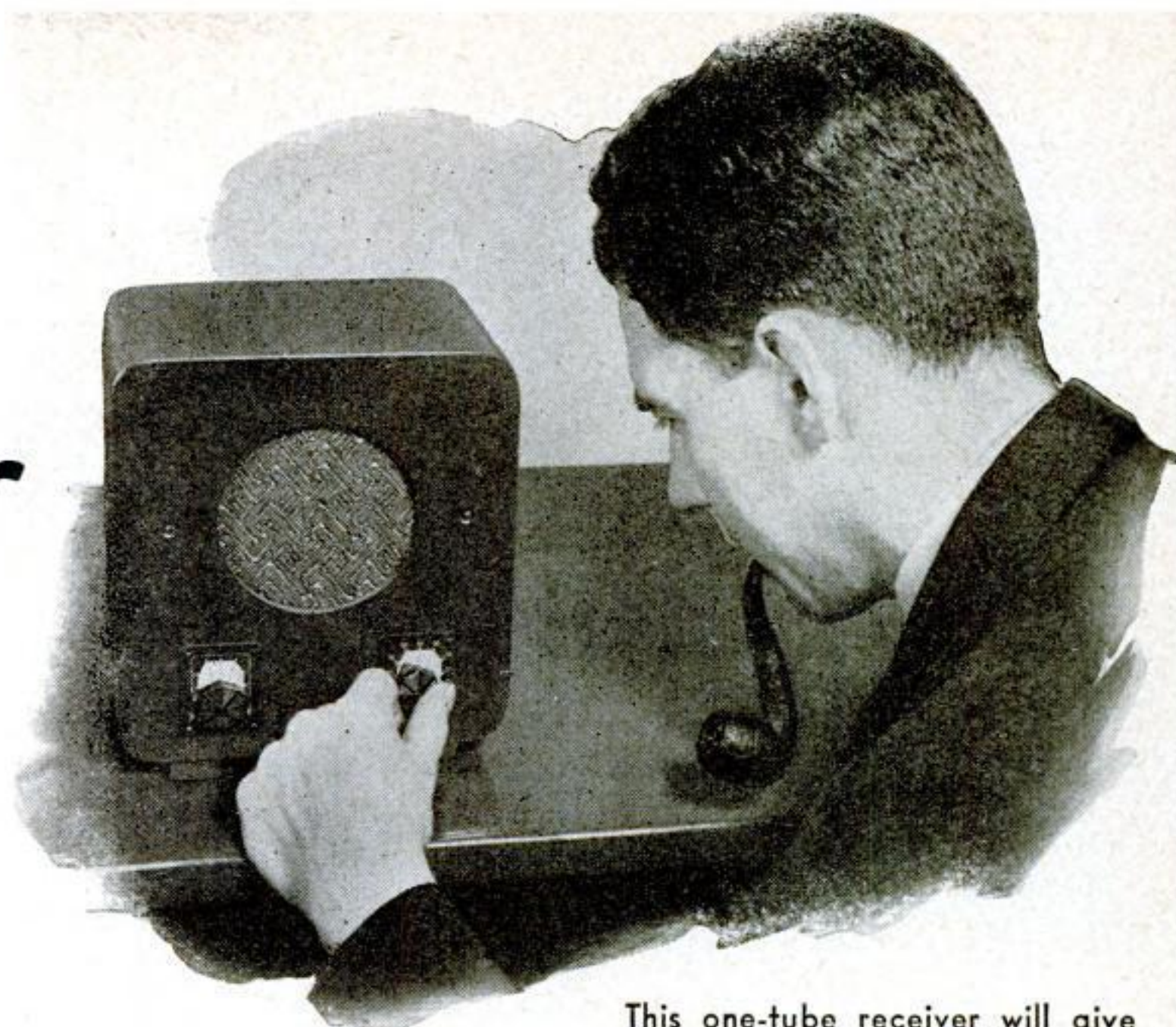


## Handy Desk Mount for Microphones

**ANY** standard microphone can be used either as a desk or a hand type with the aid of a novel mount now on the market. Finished in black enamel, the stand has a spring clamp that grasps the microphone handle to hold the instrument in an upright position for use on a desk or table. Since it is not held by bolts or set screws, the microphone can be easily and quickly removed from the base for use as a hand instrument. It is expected to be especially useful for sports announcers.



# ONE TUBE POWERS THIS Compact Loudspeaker Radio



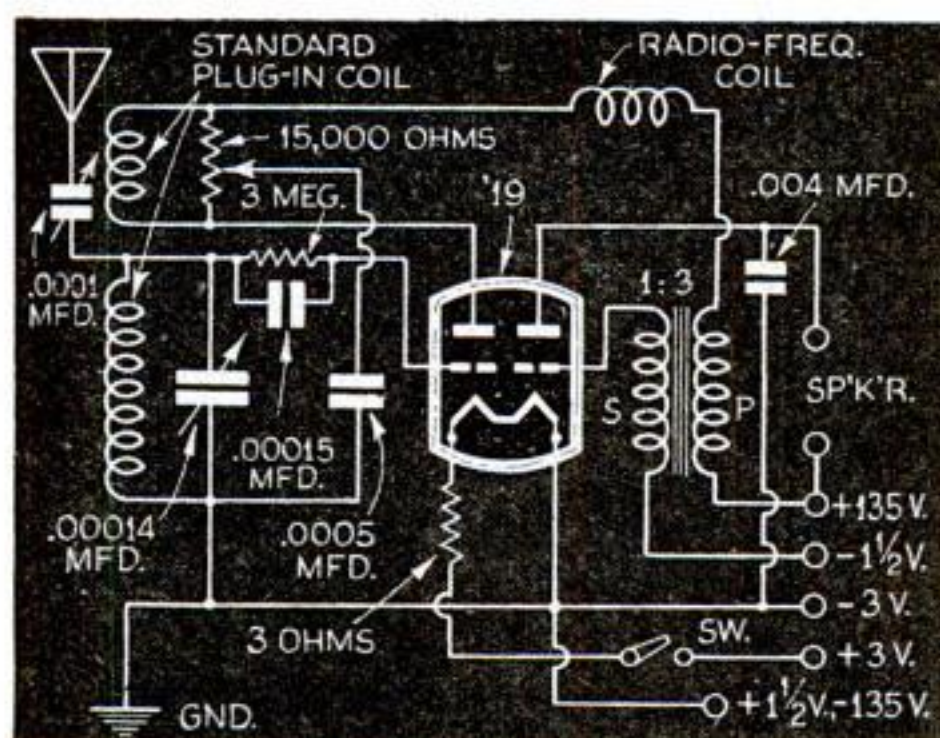
This one-tube receiver will give fine results with a good antenna

By  
**FRANK  
TOBIN**

**D**ESIGNED as an inexpensive auxiliary set for use in the kitchen, the den, or a child's playroom, the easily built, battery-operated one-tube receiver shown will give good loudspeaker reception on local stations when connected to an efficient outside antenna. Though it may not be the first time that a single tube has been used to obtain loudspeaker results, it is perhaps the first time that those results have been achieved without incorporating complicated and tricky hook-ups into the design.

As indicated in the diagram, the circuit consists of a straightforward regenerative detector, transformer-coupled into an amplifier. A single tube, a new dual-purpose unit (type '19), serves as both the detector and the amplifier. This tube has been available to radio amateurs for several months and can now be obtained from any large dealer in radio parts. It is available with a standard base or with the newer "octal" base. Either model may be used, the only difference being that the octal type has a slightly lower filament consumption.

Regeneration in the circuit is obtained by means of a 15,000-ohm, wire-bound variable potentiometer. This is connected across the tickler winding



How to wire the battery-powered hook-up is clearly outlined in the diagram above

of the plug-in coil with the contact arm grounded through a .0005-mfd. fixed mica condenser. A .00014-mfd. midget variable condenser serves as the main tuning condenser. The tuning condenser and the combination switch and potentiometer are the only controls on the front panel.

To eliminate any unnecessary losses and make it possible for the set to operate on the shorter wave lengths, isolantite or similar sockets should be used for the tube and plug-in coil. High-quality insulation also should be used on the antenna trimmer condenser and radio-frequency choke coil.

Two pieces of sheet aluminum one sixteenth of an inch thick serve as the chassis. The base, L-shaped and measuring two inches high by five and a quarter inches wide, is attached to the subpanel, which measures seven inches wide and seven and a quarter inches high, by means of two machine screws. A hole, four and a quarter

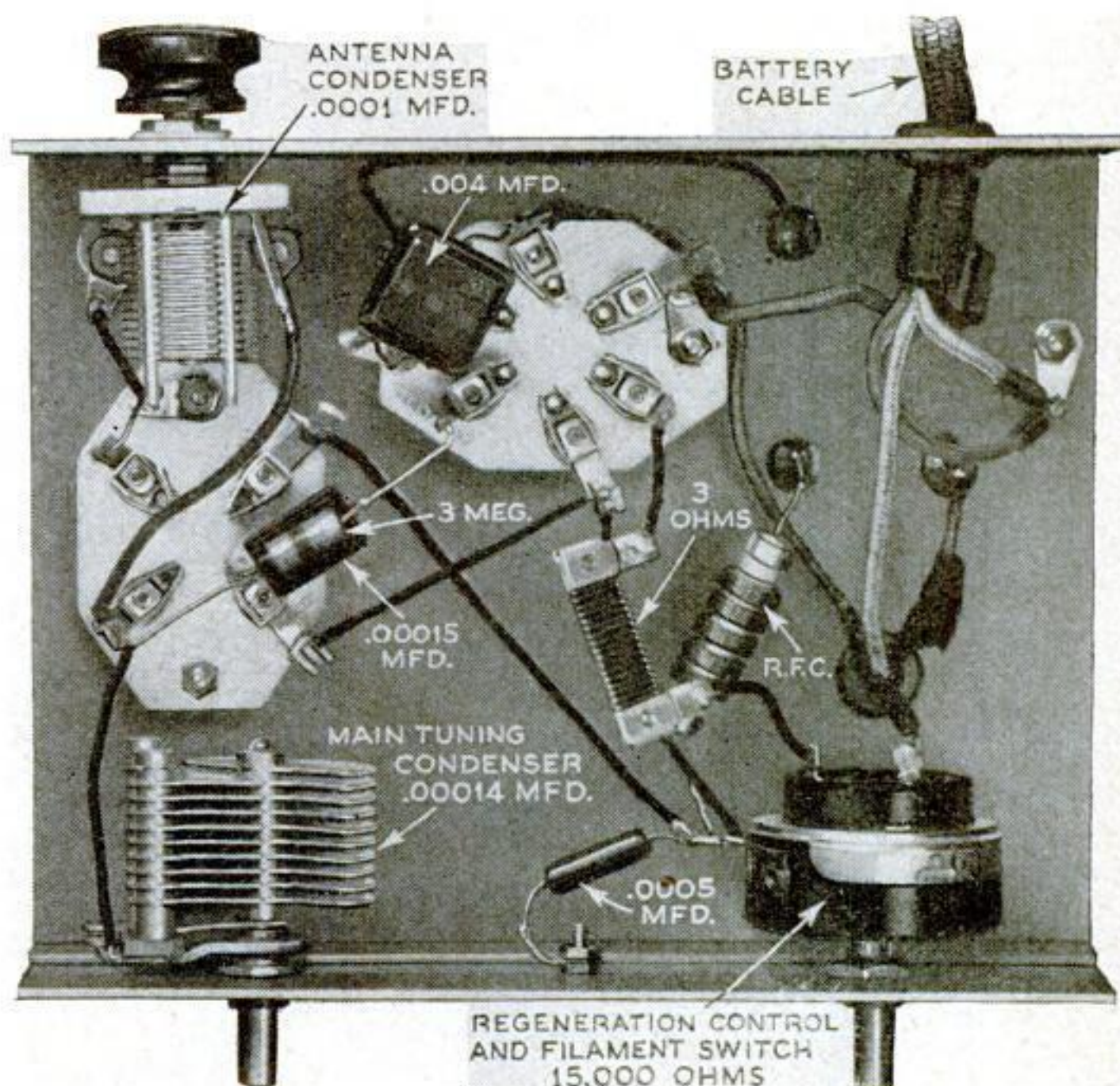
inches in diameter, drilled in the panel serves as the opening for the five-inch speaker.

The cabinet for the compact receiver can be easily built at home. The sides, top, and bottom are pine about three eighths of an inch thick, while the front should be slightly thinner. This will allow the shafts of the volume and tuning controls to extend out far enough to provide ample room for the knobs.

To enhance the general appearance, the edges of the cabinet along the four sides can be curved slightly, and the whole cabinet can be supported on two thin strips of wood as shown. This will help to create a pleasing modernistic effect. Almost any common type of finish can be applied to the cabinet. In finishing the original, I used one coat of brown enamel applied over a single sizing coat of shellac.



Rear view of the set, showing the tube, audio transformer, plug-in coil, and speaker



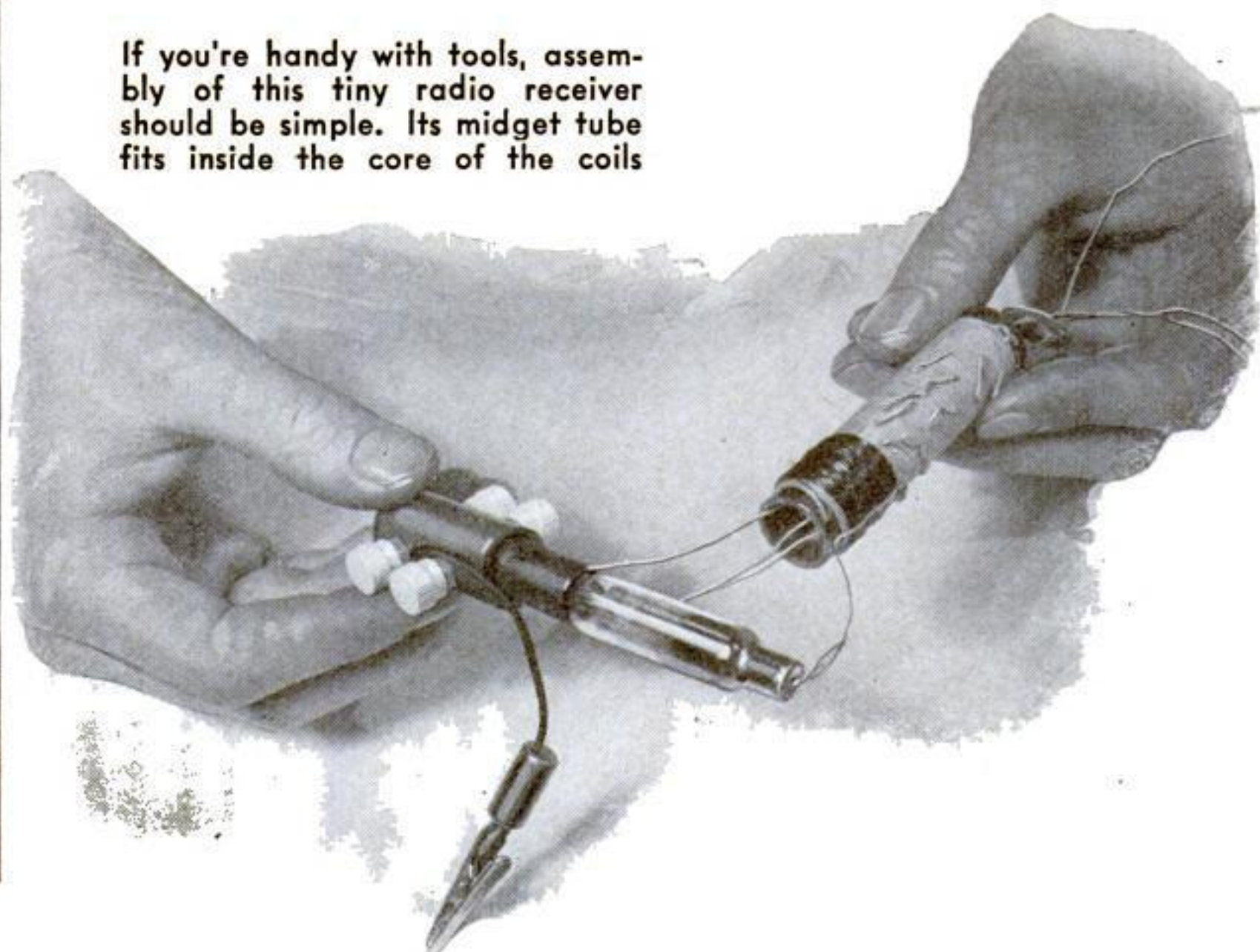
The deep chassis provides plenty of room for mounting the parts





Moving a spring clamp to various tuning-coil taps tunes the set

If you're handy with tools, assembly of this tiny radio receiver should be simple. Its midget tube fits inside the core of the coils



# Fountain-Pen Receiver

## FITS IN YOUR VEST POCKET

By Clark Maxwell

**L**ITTLE larger than a pocket flashlight, this midget one-tube broadcast receiver is small enough to be carried in your vest pocket. Powered by two standard flash-light cells connected in series for the "A" supply, and one small forty-five-volt "B" battery, the tiny set gives excellent earphone volume on broadcast stations within a radius of seventy-five miles. Because it is compact, it serves as a handy radio companion for the hiker or the cyclist.

The cylindrical "cabinet" for the set can be easily made from a five-inch length of composition tubing three quarters of an inch in diameter. As shown in the photographs, the tubing is cut to provide two sections. One, one and three-quarters inches long, will be referred to as section "B"; the other, three and a quarter inches long, will be called section "A." The tuning coil and the loading coil are wound around section "A." The tuning coil consists of 150 turns of No. 30 double-cotton-covered wire, tapped at the fiftieth turn and every tenth turn thereafter. The loading coil, consisting of 100 turns of No. 28 enameled wire, is wound over the first fifty turns of the tuning coil and in the same direction. This layer-type winding makes it possible to provide a large number of turns within a short space and permits the circuit to tune higher than 500 meters.

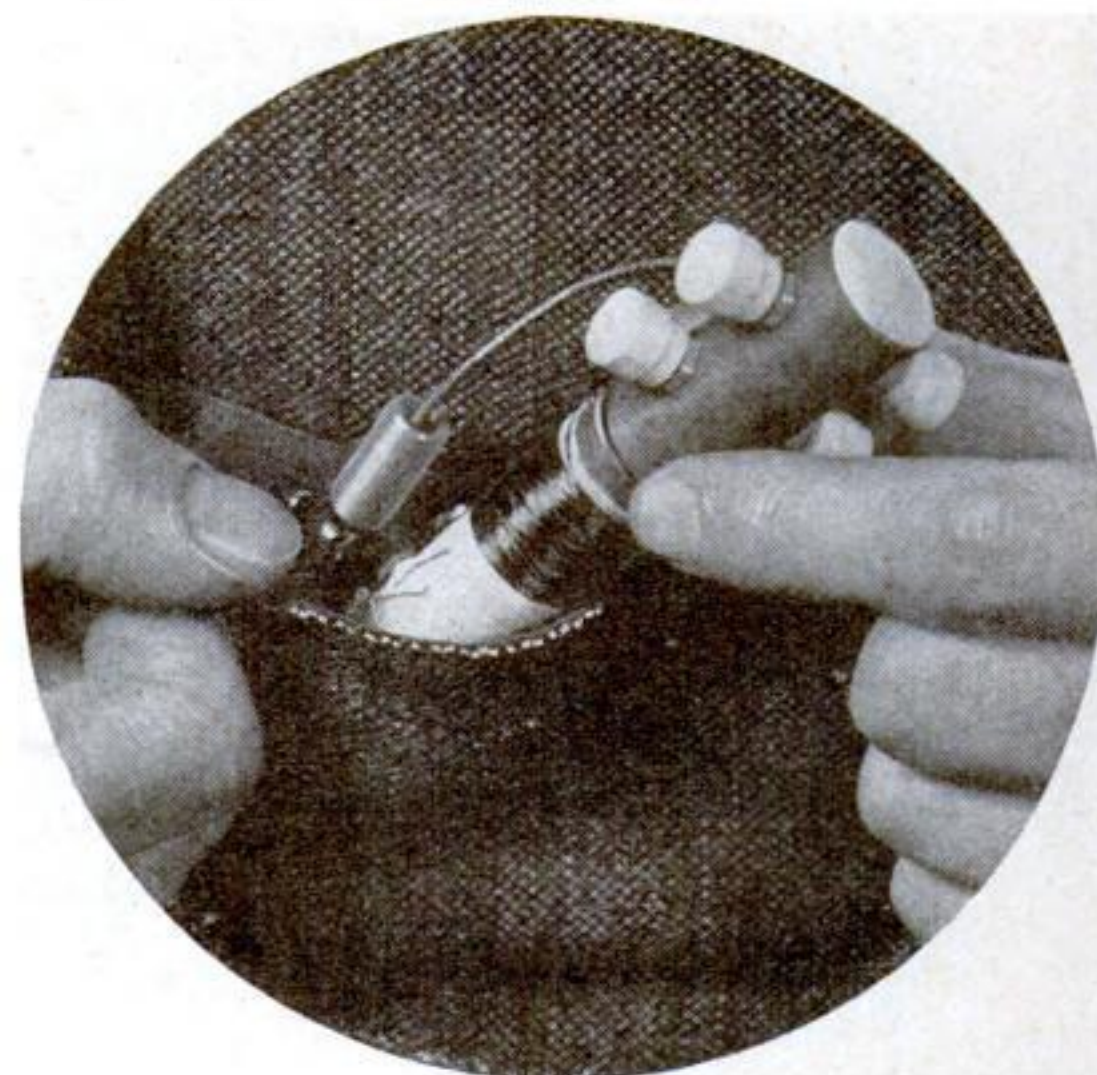
The single ultra-midget tube (type XSG) fits inside of the "A" section. To make it an easy sliding fit, however, its base must be removed. This is a delicate operation, but should not present any great difficulties if you proceed carefully. First remove the tips of the

tube prongs with a saw. This detaches the inner connecting wires soldered to the ends of the prongs. Next saw the base itself into two sections. If this is done carefully, it will be a simple matter to break the base away from the glass bulb. Finally, electrician's tape should be wound around the exposed base wires and the metal plate cap at the top to insulate the connections made at these two points.

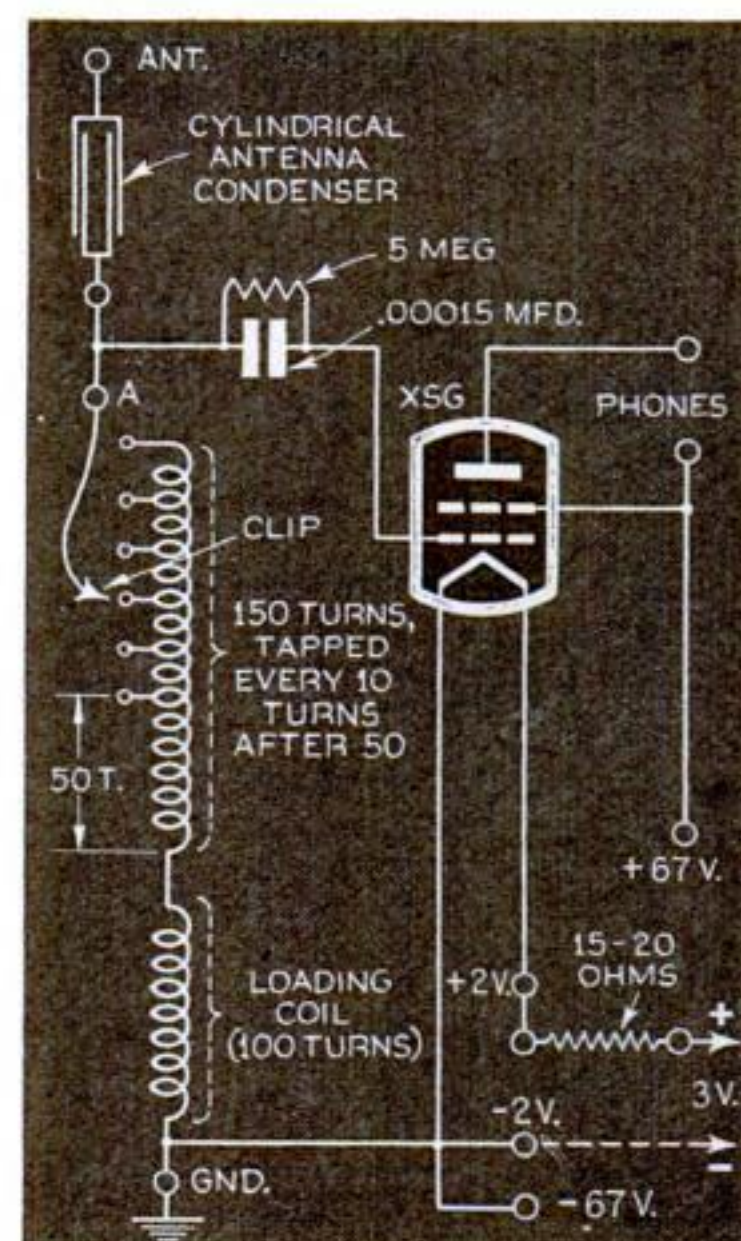
Holes drilled on each side of section "B" take the four binding posts, for the antenna, ground, and earphones. A flexible lead fitted with a spring clip is connected to the antenna binding post from the inside, and passes through a small hole in the tubing. When the set is in operation, this clip is changed from one tuning-coil tap to another in order to adjust the set to the different wave lengths.

To obtain more critical tuning, the author connected an adjustable tuning condenser into the antenna lead. As shown in the photographs, it is a tubular unit whose effective capacity can be varied easily by adjusting the two telescoping sections. If desired, a .00032-mfd. air-spaced tuning condenser may be substituted.

Detailed diagram of the hook-up, at right. The variable antenna condenser below improves tuning



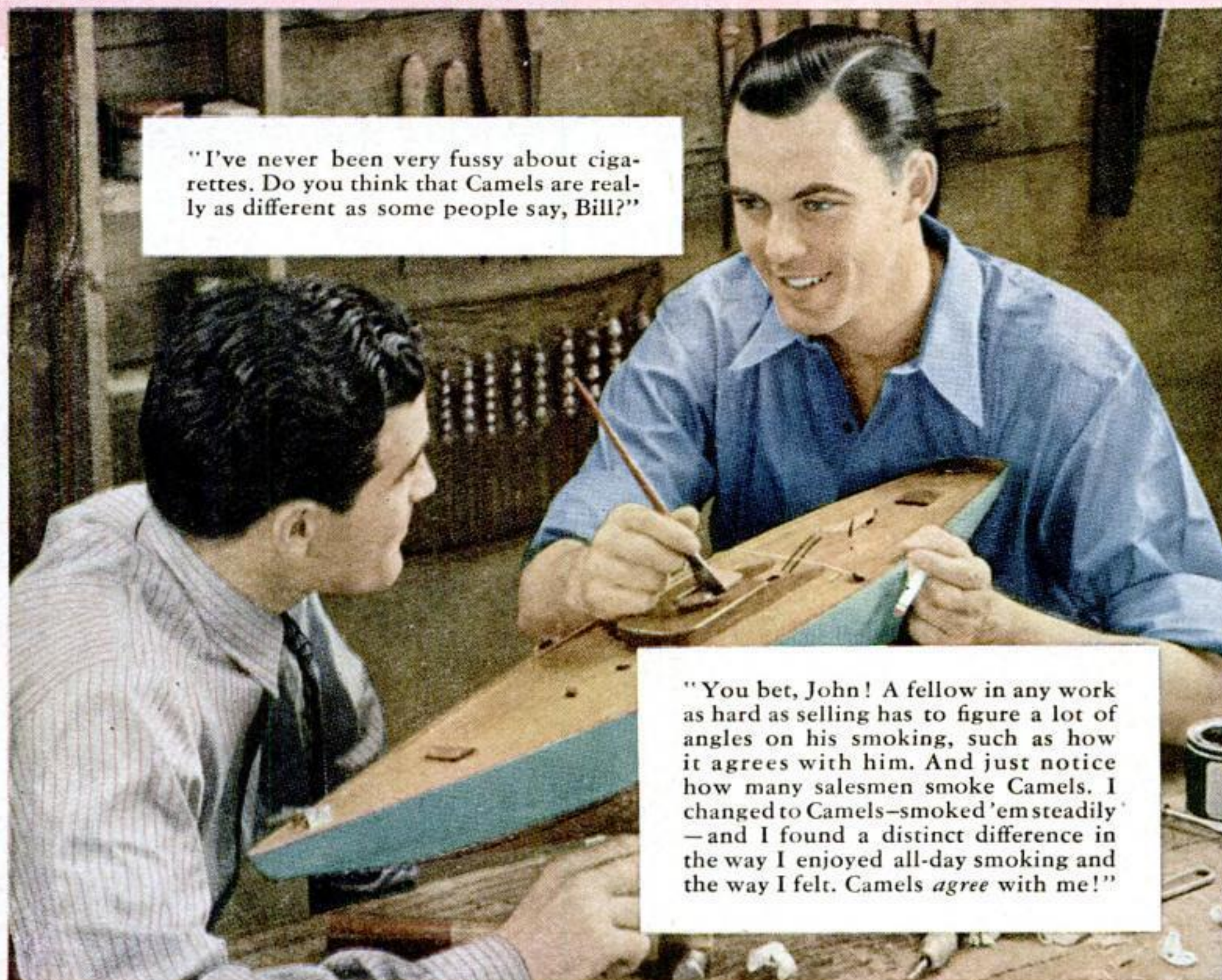
The compact set fits easily into a vest pocket





# "Are Camels Really different from other Cigarettes?"

A QUESTION OF INTEREST  
TO EVERY SMOKER



"I've never been very fussy about cigarettes. Do you think that Camels are really as different as some people say, Bill?"

"You bet, John! A fellow in any work as hard as selling has to figure a lot of angles on his smoking, such as how it agrees with him. And just notice how many salesmen smoke Camels. I changed to Camels—smoked 'em steadily—and I found a distinct difference in the way I enjoyed all-day smoking and the way I felt. Camels *agree* with me!"

**A FRIEND DROPS IN** to see Bill's model racing sloop. Daly passes the Camels and answers a question about smoking: "That all-cigarettes-are-alike talk doesn't square with my experience. Steady smoking is the test that shows Camels in a class by themselves. They don't make my nerves 'edgy.'"

...When H. W. DALY, 34, rayon salesman, says: "Yes, Camels are really different," millions of other smokers back him up. And that explains why Camels are preferred by the *largest*, as well as the most enthusiastic, body of smokers ever known.



**A KISS FROM MARITA** (Mrs. Daly) and Bill is off to his job in the city. The Dalys agree about Camels. Mrs. Daly smoked them first, soon noticed a difference. "Now we find that Camels agree better with both of us," she says.



**MARITA'S PLANNING** a grand feed. "We enjoy entertaining," she says. "I like plenty of Camels at the table. Camels cheer up digestion. They even cheered up Bill's disposition."



**ON WEEK-ENDS**, Bill's a candid camera fan. On week days he "pounds the streets." "When my energy begins to fail," he says, "I get a quick 'lift' with a Camel."



PEOPLE DO APPRECIATE THE  
**COSTLIER TOBACCOS**  
IN CAMELS

THEY ARE THE  
**LARGEST-SELLING**  
CIGARETTE IN AMERICA

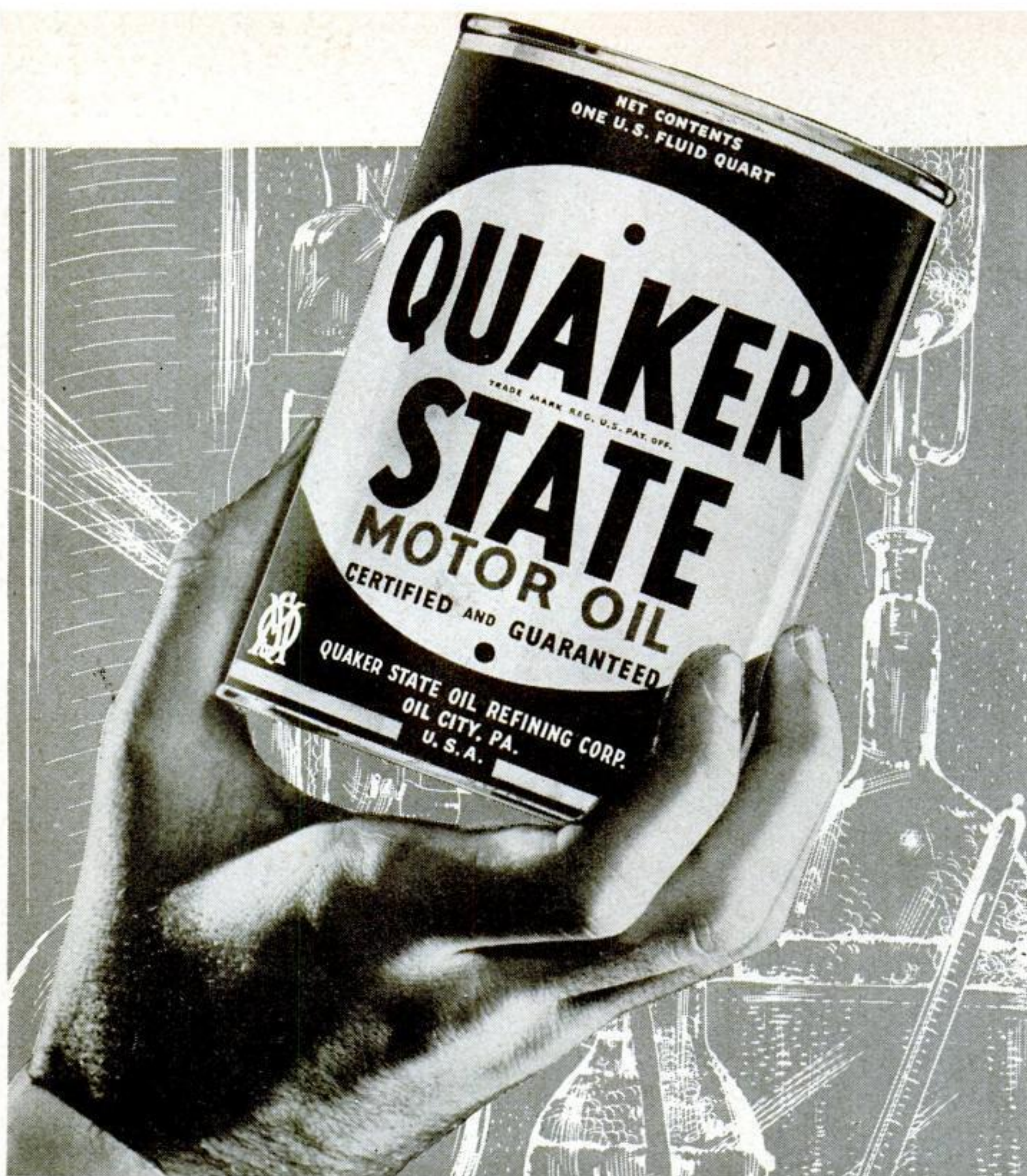
A matchless blend of finer,  
**MORE EXPENSIVE TOBACCOS**  
—Turkish and Domestic

Copyright, 1938, R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

ONE SMOKER  
TELLS ANOTHER..

## "Camels agree with me"





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**Buy Acid-Free  
Quaker State**

**MAKES CARS RUN BETTER  
LAST LONGER**



*Old  
Bill*

SAYS:



**A**RGUMENTS about cracks in hardened steel often arise in the machine shop. Here is a rough and ready way to settle them: Few cracks, deep and wide, are the result of poor heat treating. A surface network of cracks, on the other hand, is an indication of abuse from grinding.

Recently I saw a machinist build up, by welding, four broken teeth on a 50-in. gear and thus avoid a plant shutdown. When the dental work had been ground to shape, the gear looked like a new one.

Give a diamond truing tool a quarter turn each time before dressing a grinding wheel. When the diamond has made a complete revolution, split between the four previous positions for the next four dressings. If you keep repeating this cycle, you will always have a fresh cutting edge on the diamond.

Scribed lines on sheet metal can be seen more readily if the sheet metal is heated until it turns a blue color.

One way to reduce defective work in a shop where interchangeable parts are made, even in such small quantities as by the dozen, is to have a model to go by. You can accidentally misread a blueprint or a micrometer, but you are not likely to go wrong when checking with a model part.

An accurate and economical way to produce large bores with a radial drill is to make flat boring tools, either of single or of multiple design, as required.

If you take a piece of steel from the scrap pile, make sure it is what you want by giving it the spark test on a grinding wheel. Soft steel gives light straw sparks; carbon steel, white sparks; and high-speed steel, chrome yellow sparks.

## How to Apply White Paint Over "Bleeding" Colors

IF YOU have ever tried to put a coat of white paint, lacquer, or enamel over another color, particularly red, and seen the beautiful white assume a streaked or tinted shade because the underlying color began to bleed through, you will appreciate this little tip:

First, take off all the old finish with a remover, by sanding, or by using a blowtorch and scraper. Next, apply a coat of silicate of soda (water glass), thinned with water until it is about the same body as table syrup (or, for spraying, to the same consistency you would ordinarily thin lacquer). After this has dried, sand lightly, and you are then ready to refinish.—C. A. VOELCKEL.



## HO-Switches and Track

(Continued from page 77)

machine. It is also possible to work switches from a distance by using lengths of fishline or wire.

Once you have laid a foot or two of track and built a switch, you can begin to plan a final track layout. It is impossible to give many specific suggestions, because each builder has his own space problems, but to illustrate some of the problems involved, two layouts are shown, both being designed for the same space, 10 ft. long and 8 ft. wide.

Layout No. 1 is a typical example of the novice model railroader, while layout No. 2 is of a type that would be made by the more experienced.

THE principal trouble with the first layout is that the designer has attempted to put in too much. In doing so, he crowded the available space and worked in too many sharp curves. The double-track main line and cut-off connecting its opposite sides is a fairly desirable feature, but a little too elaborate for this space.

Compare this with the wide, swinging curves of the second layout. Here the mechanical effect of a perfectly rectangular layout is avoided by cutting off one corner. This allows some extra space for scenery, and avoids a crowded look. Almost half the main line is made double-track to add interest in operation. For instance, two trains could be run in opposite directions, with the speeds controlled by means of individual sections of third rail so that they passed each other in the double-track portion. This calls for alertness on the operator's part, and is much more fun.

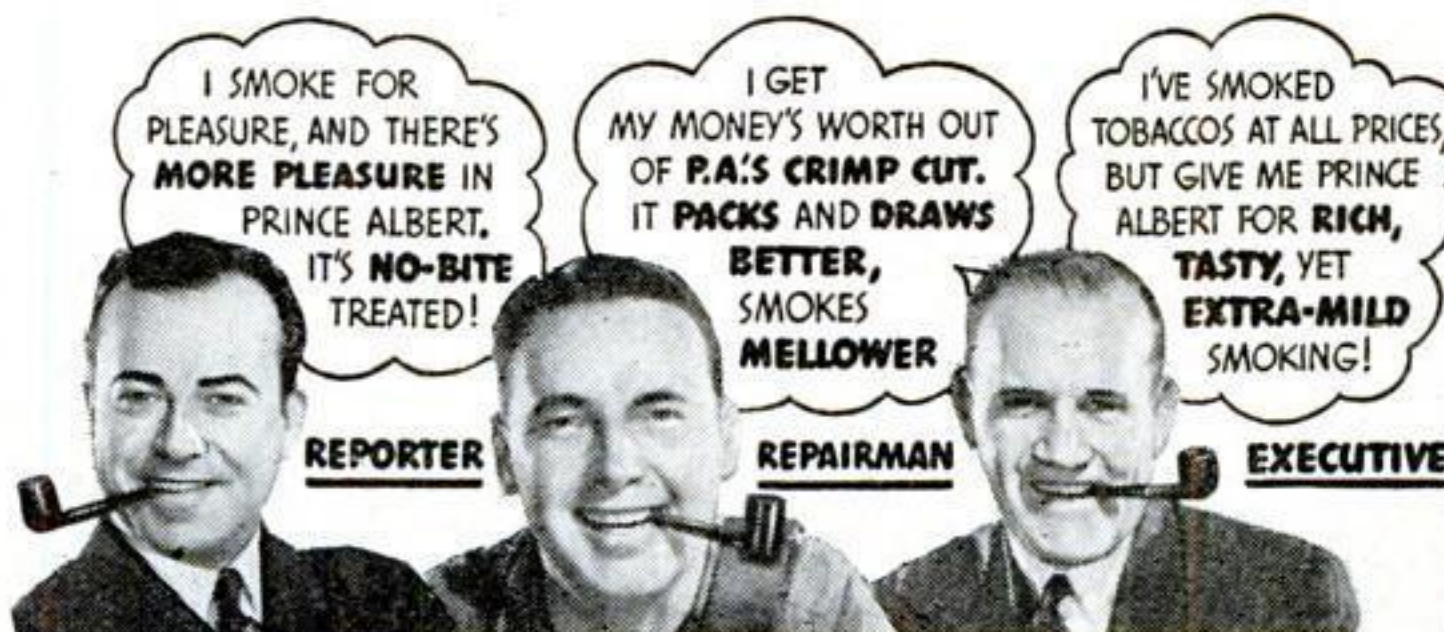
The passenger terminal is made of moderate size, but is arranged so that trains can pull in, then leave in the same direction. All the important switches are arranged so they can be reached from two edges of the table. This is important even if they are remotely controlled, because the majority of derailments occur on switches, and the cars must be in a position where they can be reached conveniently. The yards in layout No. 1, to mention another objection, are far too large in proportion to the amount of trackage.

Whatever your layout, do not make the mistake of building it at floor level. Half the realistic effect is spoiled if you do so, and the difficulty of building and operating it is greatly increased. Make the table on which the layout is placed at least 3½ ft. high. It can be built from any rough lumber, strongly braced, and may be covered with three-ply fir plywood. The layout can be made in sections, if desired, for portability (see P.S.M., Dec. '37, p. 99).

If you plan to have any bridges or trestles in your layout, you will have to provide low places in the table so as to have real valleys for them to cross. This should be planned ahead of time, so you will not have to rebuild the table when you put in the bridges. The gaps may be spanned temporarily by boards until the final structures are complete.



## FOR THE REAL PLEASURE IN SMOKING



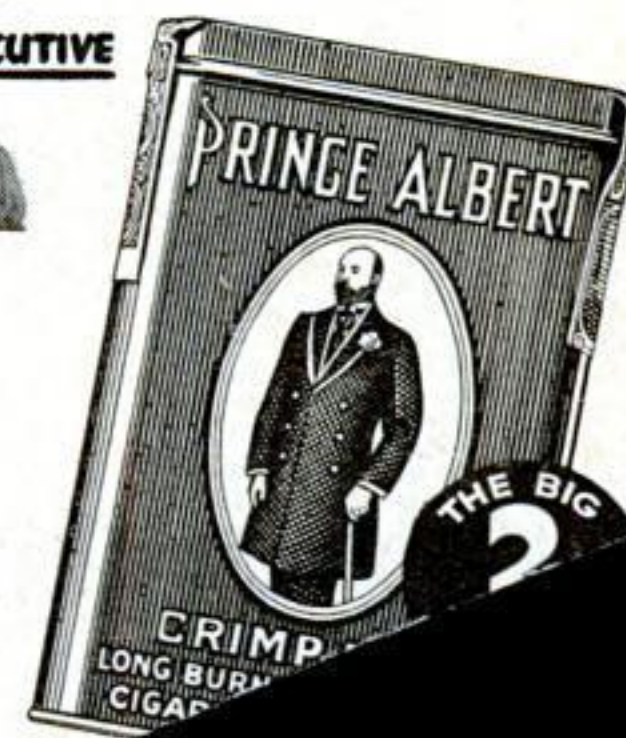
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PIPE-JOY  
CLUB!

### TO WIN NEW FRIENDS—MONEY-BACK OFFER!

Smoke 20 fragrant pipefuls of Prince Albert. If you don't find it the mellowest, tastiest pipe tobacco you ever smoked, return the pocket tin with the rest of the tobacco in it to us at any time within a month from this date, and we will refund full purchase price, plus postage. (Signed) R. J. Reynolds Tobacco Company, Winston-Salem, N. C.

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**1. Your camera loaded  
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Photoflood lamps in  
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**FREE BOOKLET**—Suggests a variety of picture opportunities . . . shows you how to arrange your lights . . . how to place your subject . . . tells you everything you need to know about two ways to make night pictures—*snapshots* with Photoflood lamps, *fast exposures* with Photoflash lamps. (You can use Photoflash lamps, each good for one picture, if your camera can be set for "time.") Be sure to get a free copy at your dealer's today . . . Eastman Kodak Company, Rochester, N. Y.





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NEW CAR  
MR. JONES!**

**YES. IF ONLY IT  
WOULD STAY NEW!**

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WILL HELP TO KEEP THE ENGINE PER-  
FORMANCE LIKE NEW—FOR A LONGER  
TIME.**

**WHAT CAN I DO TO  
ACCOMPLISH THAT?**

**USE PYROIL REGULARLY. PYROIL KEEPS  
OUT HARD CARBON, GUMS, SLUDGES AND  
CORROSION. THESE THINGS FOUL EN-  
GINE PERFORMANCE AND CAUSE EARLY  
REPAIRS!**

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Please tell me how I can keep my engine performance like new, for a longer time, with Pyroil.

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## Deck Work on the 'Alabama' Model

(Continued from page 83)

these holes at the fore and main, construct the fife rails. These are started by setting the sheet bitts (forward posts) into the deck. They have two holes each, fore and aft. Their upper ends can be square and solid, or cleft for hitching ropes to, as sketched.

From the sheet bitts extend the pinrails, the other ends of which are supported by turned posts or stanchions. There is a cross rail abaft. The forward ends of the pinrails may be set in mortises in the posts; the after ends are half-lapped and nailed (with a pin) through the stanchions to the deck.

At the mizzenmast the two sheet bitts alone will be sufficient.

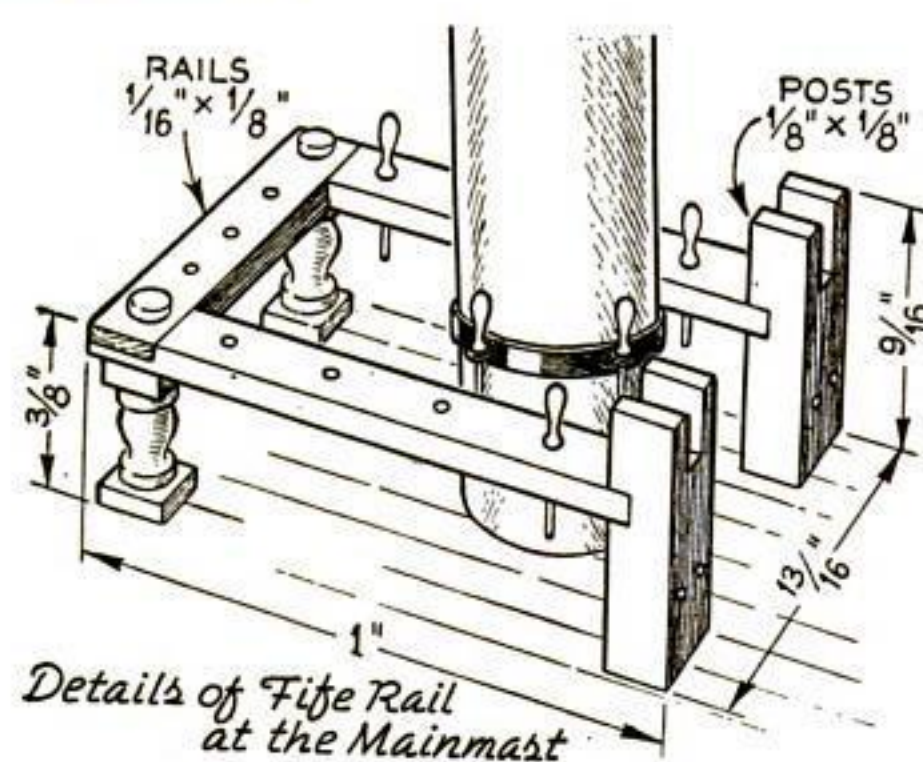
The bridge is best made of metal. Drill it for the stanchions—both those above and those below—and solder them in position. Under the ends, solder curved wires to set firmly into the bulwarks. The binnacle is filed or turned from brass rod and soldered.

Set the bridge in position with the lower stanchions projecting into holes in the deck. The rail stanchions are  $\frac{1}{4}$  in. long, of the two-ball type. Reeve very thin wires through them.

Make ladders for both sides and give them handrails of bent wire, with one end set in the deck and the other soldered to a stanchion.

The funnel is set on a casing or fiddle made of  $\frac{1}{8}$ -in. wood with a solid piece in the middle, as shown in the deck plan. The open parts at the ends are rabbeted to take gratings formed by reeving No. 24 wire through holes in strips of brass. An eyebolt is needed at each corner for the guys. The whole is painted black.

For the funnel, bend a piece of sheet metal around a  $\frac{1}{2}$ -in. stick, lap the edges, solder, and file smooth (or use a suitable piece of tubing, if available). Solder thin strips on at the top and where the eyebolts come. File, grind, or cut the lower end to the correct angle, cutting the core at the same time. Remove the core, cut off a thin piece at the lower end, and nail this



The foremast fife rail is similar to this, but at the mizzen only two posts are needed

through the casing to the deck. Cement the inside of the funnel and place it in position.

Pieces of brass tubing flared at the ends, or brass rod, may be used for the steam pipes. They are set into the casings and held at the top with eyes made from pins. Leave them unpainted.

Four eyebolts are also required for the guys. If a slice of the core is placed inside the funnel at the position of the band, these eyes will hold better. The funnel probably was painted yellow ocher, so make the outside a dark yellow ocher, and the inside black.

(TO BE CONTINUED)

## Linseed Mixture Fills Crack in Boiler

IF THE fire pot or some section of a hot-water or steam boiler becomes cracked in your house-heating system, it pays to try the following method of repair, which has been used by one of Milwaukee's oldest heating contractors for forty years:

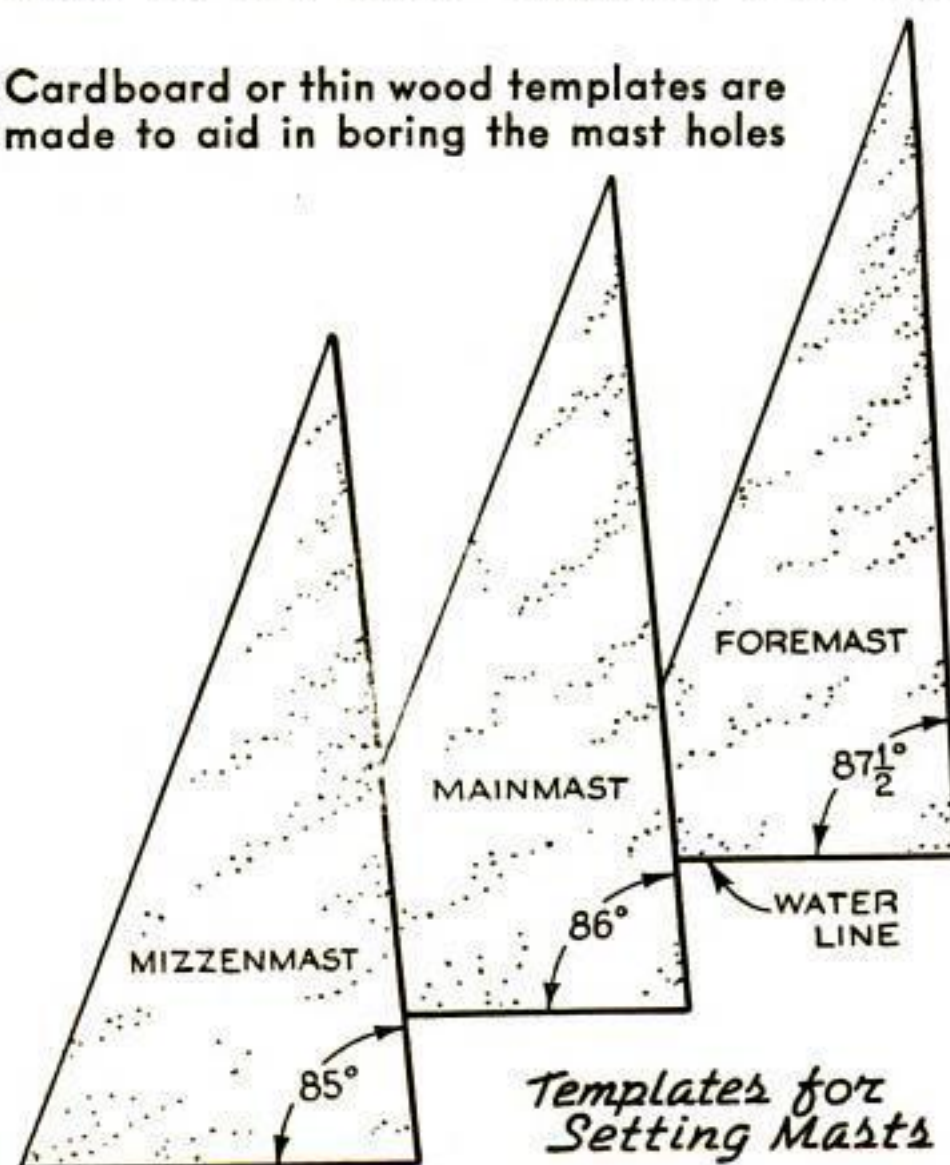
For a boiler up to 1,000 square feet, buy 5 lb. of ground linseed from a feed dealer. To this add 2 lb. of brown sugar in a 2½-gal. pail, and pour in warm water, stirring until well mixed. For larger boilers, double the amount.

If the system is hot water, let out enough water so the so-called "altitude" gauge on top of the boiler may be removed. On a steam boiler, merely remove the steam gauge. It is not necessary to let the fire go out entirely; simply keep the feed door open to check the fire.

Pour the mixture in through a funnel, and use a stick to force it down. If the boiler does not take the entire amount in a hot-water system, let out more water. Next replace the gauge and fill the boiler again to the top, or a little more (but not the radiators). Start the fire gradually and keep it burning slowly for two hours. After that you can refill the entire heating system and raise the temperature.

A 6,000-sq. ft. boiler in an office building which was repaired by this method three years ago is still standing up.—HERBERT W. RUTZEN.

Cardboard or thin wood templates are made to aid in boring the mast holes



Templates for  
Setting Masts



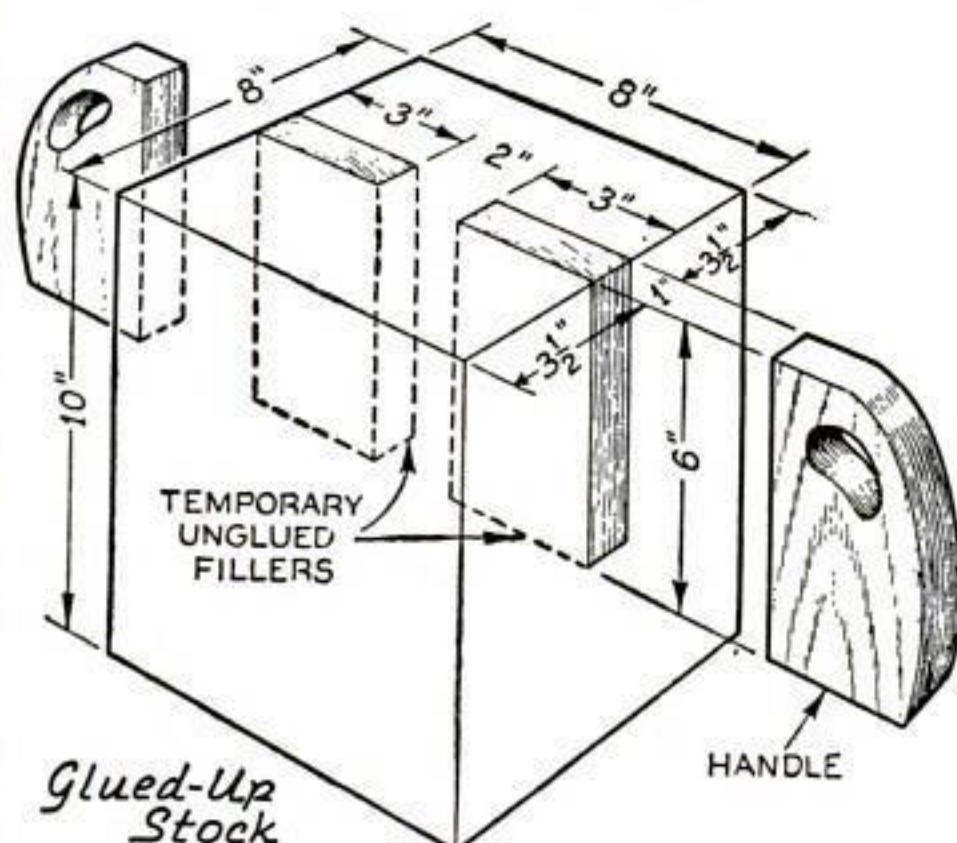
## Lamp Resembles Pottery

(Continued from page 74)

pieces and make their removal difficult. Dress the fillers down slightly to form a sliding fit, after which a few spots of glue on the inner edge will hold them fast while turning.

To facilitate turning, remove the surplus corners of the stock on a jointer, plane them off by hand, or use a rip saw. The profile may be checked while turning by means of a cardboard template. When the shape is correct, carefully sandpaper the work and pry out the filler blocks with a thinly ground chisel. The vase is then removed from the lathe, and the surplus stock cut away.

The stock for the handles is next inserted and the profile of the vase drawn on it, after which the blocks are removed and the shape of the handles drawn. The handle pieces are then



The stock is glued up in such a way as to provide recesses into which the handles fit

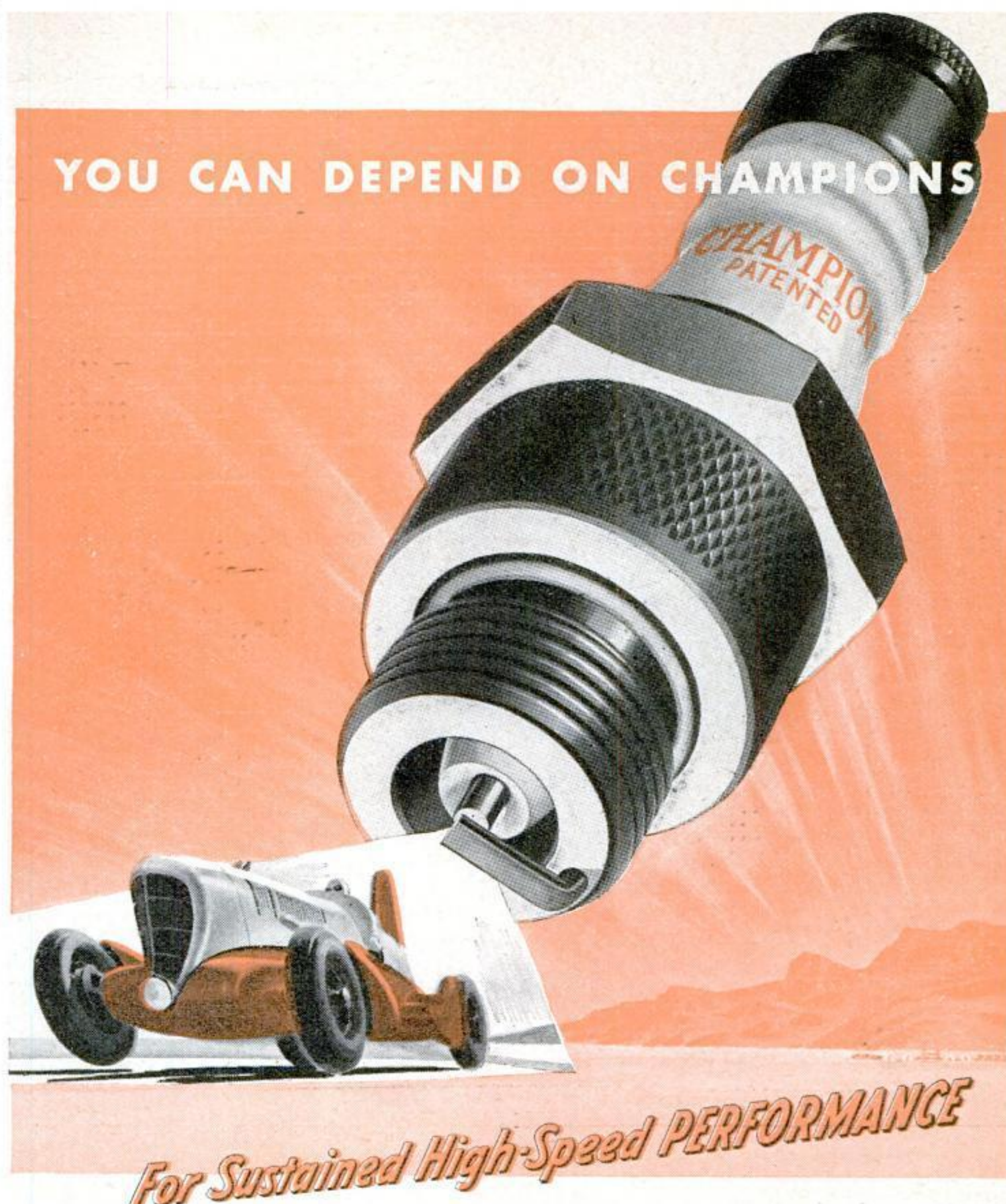
sawed out and sanded to the shape shown on the cross-section drawing marked A-B. The handles are placed back in the lamp, and if the fit is satisfactory, are glued in place, after which the joining surfaces are sanded smooth.

It will now be noted that the inner corner between handles and vase are sharp. These must be rounded with a plastic composition wood applied with a round  $\frac{1}{2}$ -in. rod of either wood or metal. Keep the rod well moistened with the solvent sold for softening composition wood. Remove the surplus plastic material immediately and let the corners harden well; then smooth them with fine sandpaper.

An opening for wire may be made at the time the stock is glued together, or a  $\frac{3}{8}$ -in. hole may now be bored. This will be slightly smaller than the  $\frac{1}{8}$ -in. pipe used to hold the socket, so the hole may be tapped out as far as possible with a  $\frac{1}{8}$ -in. pipe tap or reamed out to receive several inches of pipe. A reamer for this purpose is easily made by filing or grinding a number of teeth on the end of a piece of  $\frac{1}{8}$ -in. pipe. It is used in a brace or drill chuck.

The lamp may be finished with lacquer or enamel in ivory color or as desired.

This project is excellent for classes in wood turning or for anyone who owns a lathe.—EDMUND C. HANLEY.



When Ab Jenkins recently broke 87 World's, International and American speed records, on the Bonneville Salt Beds, averaging 157.27 miles per hour for 24 hours, he wrote an amazing bit of history involving a methodical man and a carefully prepared motor.

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Thus once again the soundness of Champion's 27-year-old policy of constant and tireless research and engineering, applied to the only product manufactured by Champion, has been confirmed. This concentration has kept Champion

Spark Plugs everlastingly ahead in performance and dependability.

Every engine performs better with Champion Spark Plugs because they are made with that one purpose in mind, regardless of cost. The same quality of materials and design, the same exclusive and patented features are used throughout the entire Champion line, right down to the tiny spark plugs built for model airplanes.

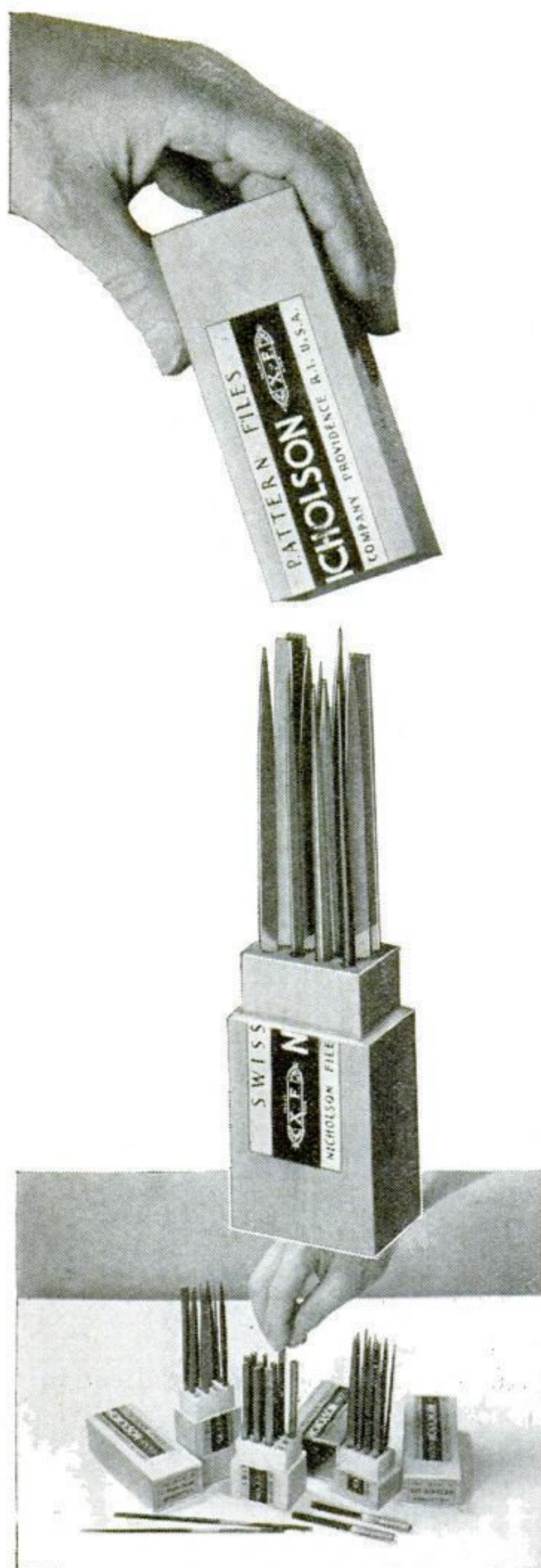
Demand Champions for your car because you can depend on them. Dependable dealers everywhere sell dependable Champions.



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CHECK AND CLEAN SPARK PLUGS WHEN YOU CHANGE OIL





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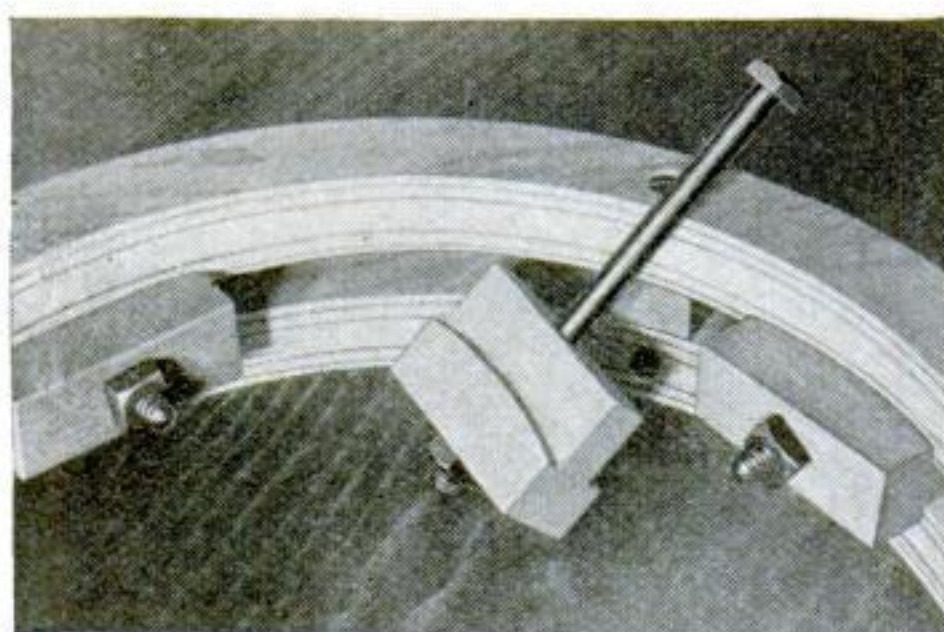
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**A FILE FOR EVERY PURPOSE**



A more elaborate type of clamp with two separated rings and several sliding blocks

## Homemade Ring Clamps

(Continued from page 85)

used. To make this arrangement more convenient, another ring of the same size may be mounted directly over the first ring and separated from it by 1/2-in. spacer blocks. Wood screws passing through the rings and spacer blocks hold the assembly together. Small wooden blocks, which are drilled for the bolts and rabbeted as illustrated above, fit between the rings and may be moved around the circle so that pressure may be applied at any position without changing the bolts or drilling holes for each new set-up.

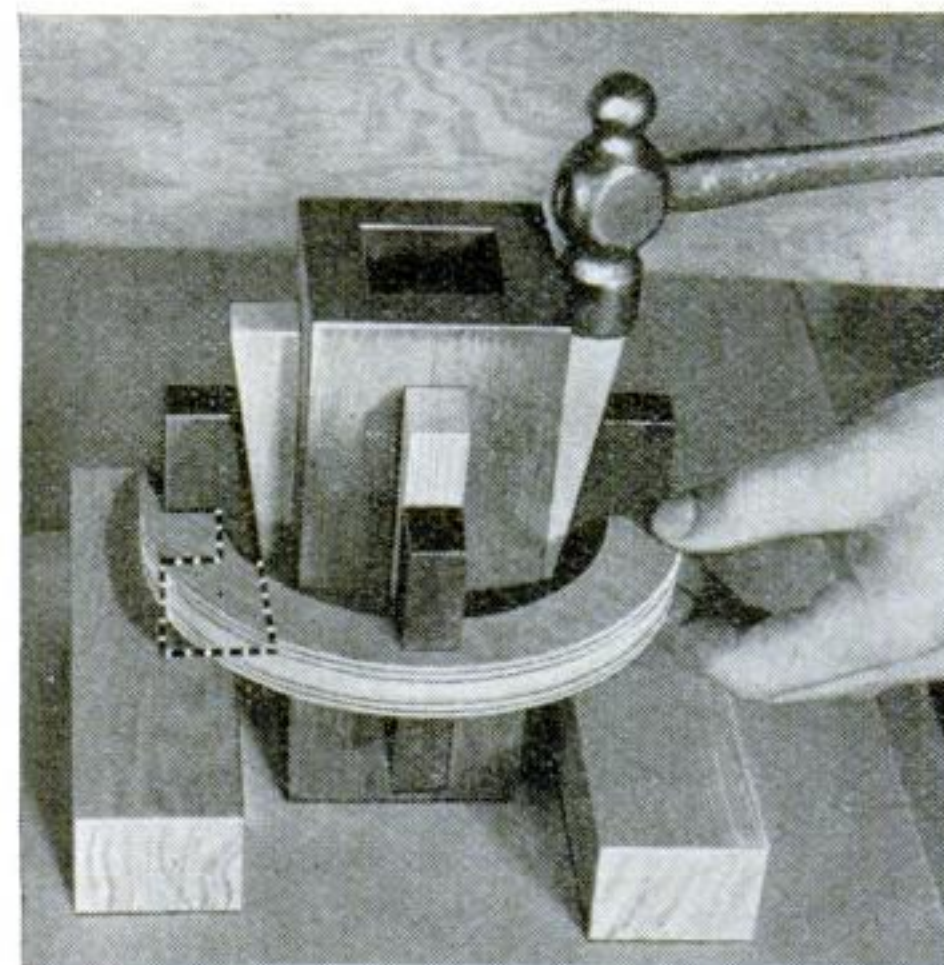
When it is desired to apply pressure from the top as well as the sides, a half section of the next smaller ring is used as shown at the beginning of the article. This is drilled and is held in place by two of the bolts that pass through the ring fastened to the baseboard. The half ring may be swung sideways in either direction, and with it pressure may be applied in any desired position.

For applying pressure from the inside, a simple jig can be made from the disk that was left when the rings were cut off. Holes are drilled around the edge, and short machine bolts are inserted and adjusted to fit the work.

There are two methods of applying

(Continued on page 109)

To apply pressure from inside, a spreader may be made as at the right. Below, a clamp with wedges. The ring rests on two wooden blocks until the wedges are hammered in place



**'IT'S SPRING!  
TIME TO CLEAN  
OUT THAT  
RADIATOR  
WITH  
SANI-  
FLUSH!'**



ALL winter long, rust and sediment have accumulated in your radiator. Fine scale is choking the cooling system of your car. Clean it out! It's easy and inexpensive. Do it yourself in a few minutes. Use Sani-Flush.

There is nothing in Sani-Flush that can injure your motor or radiator-fittings. It is a scientific powder that removes damaging dirt from the cooling system. Just pour 10c worth in the radiator. (25c for the largest trucks and tractors.) Follow directions on the can. Run the engine. Drain. Flush. Refill with clean water. Your motor will run cool. You save fuel. You don't take chances on costly repairs. You'll find Sani-Flush in most bathrooms for cleaning toilets. Sold by grocery, drug, hardware, and five-and-ten-cent stores. 25c and 10c sizes. The Hygienic Products Company, Canton, Ohio.

**Sani-Flush**   
KEEPS RADIATORS CLEAN

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## Boring Accurate Holes Through Thick Wood

SOMETIMES it is necessary to bore a hole very accurately through a thick block of wood as, for example, when fitting the rear screw of a high-powered rifle receiver through the gunstock. Difficult as this job is, it can be done if you know the trick.

The center of the hole must first be marked with a prick punch on each side of the block. Then start with a twist drill that is less than half the size of the required hole, and bore about three fifths of the way through from each side, lining up the drill by eye as carefully as possible. Follow with a drill only 1/64 in. larger than the original drill, but turn it *backward*. This cuts very slowly and does not dig in. When the drill reaches the hole from the opposite side, which is always at a slight angle to the first hole, it will follow the second hole and ream the angle down.

As soon as the drill has gone completely through the wood, continue turning it backward a long time to ream the hole as straight as possible. Continue by the same method, each time using a drill 1/64 in. larger, until the right diameter has been reached. The resulting hole will be very smooth, with the fibers of the wood burnished back, and it will be a very tight fit for a screw or a bolt the size of the last drill used.—MARK A. COOPER.

## Handy Gauge for Drilling

ON MY workbench I keep an ordinary 12-in. hardwood rule along the middle of which are holes ranging from 1/32 to 5/16 in. The size of each is marked with India ink. When I have to bore a hole to suit a certain bolt, rivet, pin, or screw, I try the fastening in several of the holes until I find the size it fits, and then select a drill.—R. J. JARVIS.

## Homemade Ring Clamps

(Continued from page 108)

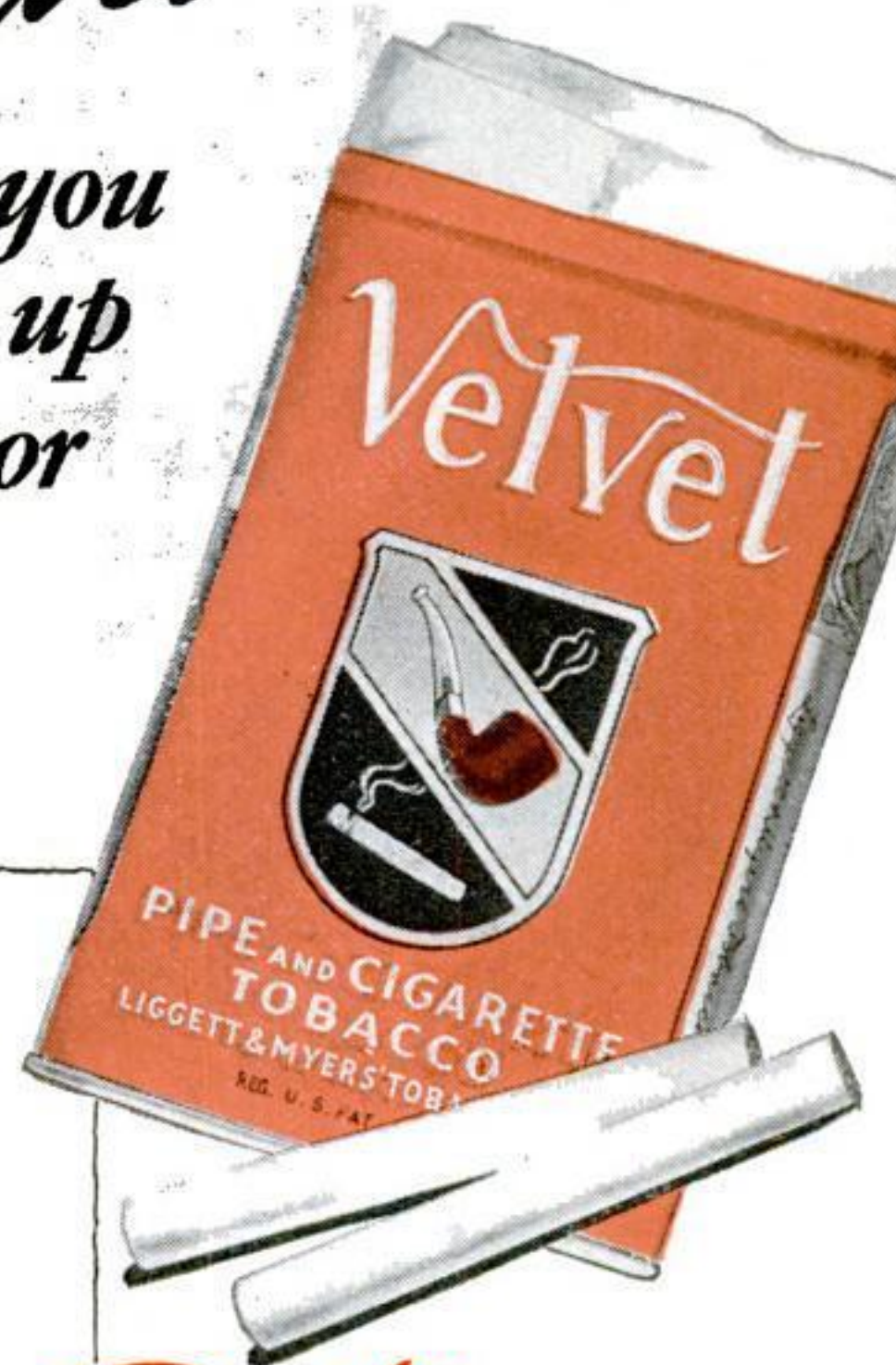
pressure when the rings are used without the baseboard. One is by means of the bolts; the other, with wooden wedges. These wedges are made in two pieces, one part being notched to fit onto the ring and the other in the shape of a regular wedge. The pieces of each pair are cut with the same taper so that the pressure will be applied squarely.

On some work it is convenient to use angle blocks. These are made from scrap wood at the same time as the work and fit over the joints while they are being glued. They not only insure accurate fitting of the joints, but also provide a means of applying the pressure without marring the work. It is best to place a strip of paper between these blocks and the work.

While the rings shown are of a size for small work, larger rings may be formed by using straight pieces of wood and securely fastening them in the shape of a circle.



*Stoke 'er up  
with Velvet  
..and you  
stoke 'er up  
with flavor*



- the **MILDNESS**  
of fine old  
Kentucky Burley  
aged in wood
- the **FLAVOR**  
of pure maple  
sugar for extra  
good taste

*Velvet packs easy in a pipe  
Rolls smooth in a cigarette  
Draws right in both*

*Better  
Smoking  
Tobacco*

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**Fun!**

THIS BOAT IS  
**LIGHT** as a feather!

**STRONG**  
as a  
giant!

OK-2  
Takes Any  
Outboard  
4 1/2 H.P.  
or  
less

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YOU GET EASY WORK AND EASY MONEY. TOO!

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GIVEN**  
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**Mail Coupon  
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Gentlemen: I am enclosing 10c postage, handling charge. Please rush me your New Colored Circular showing ALL Mead Ki-Yak models, Low Introductory Prices and \$6 Gift Paddle Offer. (Please Print Plainly)

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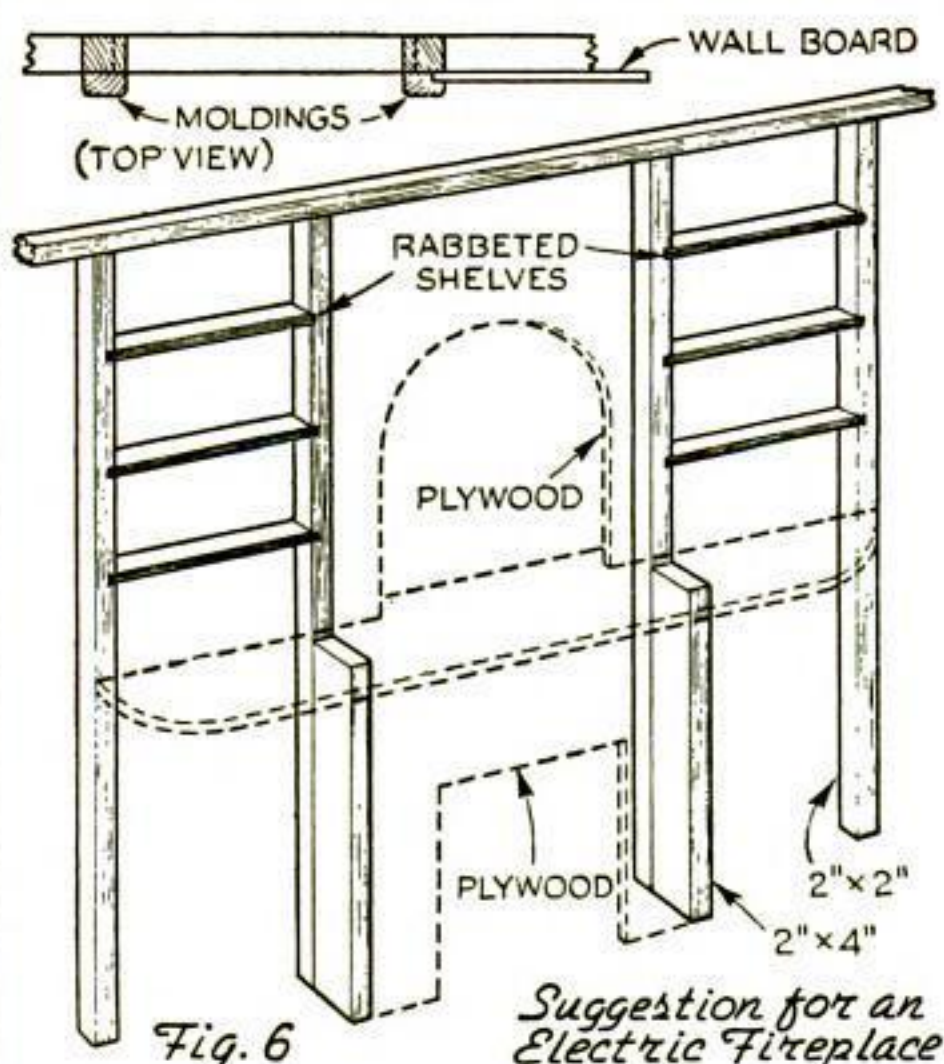


Fig. 6

Suggestion for an  
Electric Fireplace

## Hints on Dressing Up a Recreation Room

(Continued from page 81)

or pipes running along one side can be boxed, and shelves or cabinets built below.

Painting and finishing, of course, is a matter of individual choice and depends largely upon the selection of paneling. Bare cement walls can be treated with cold-water paints or special cement paints, or if they have been treated with the casein-glue whitewash mentioned in the previous article, they may be left white. It is better as a rule, however, to use the bolder colors when a room is to serve for recreation.

Your basement room is now completed, and ready for the furniture, game table, and other accessories.

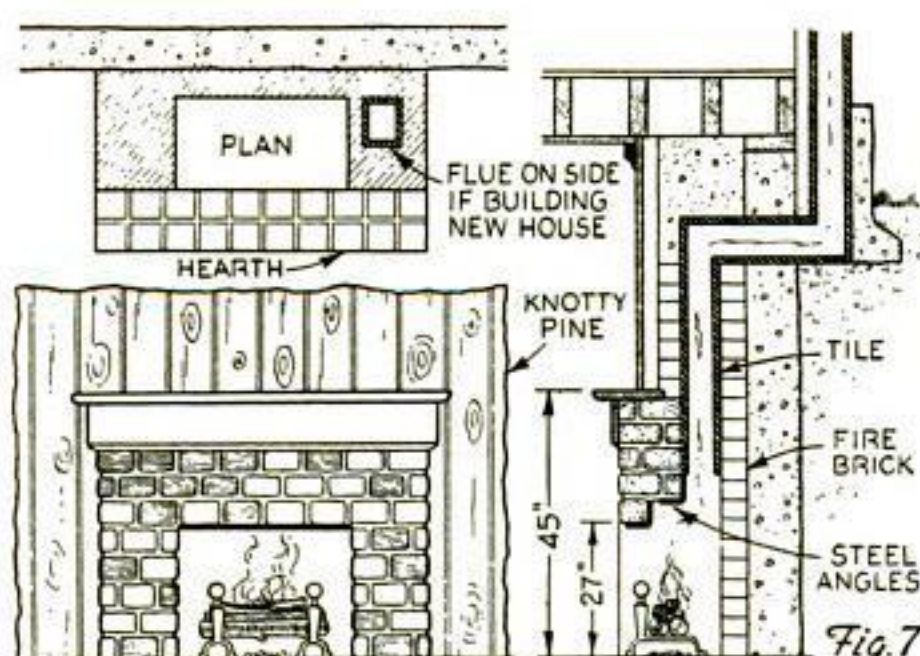
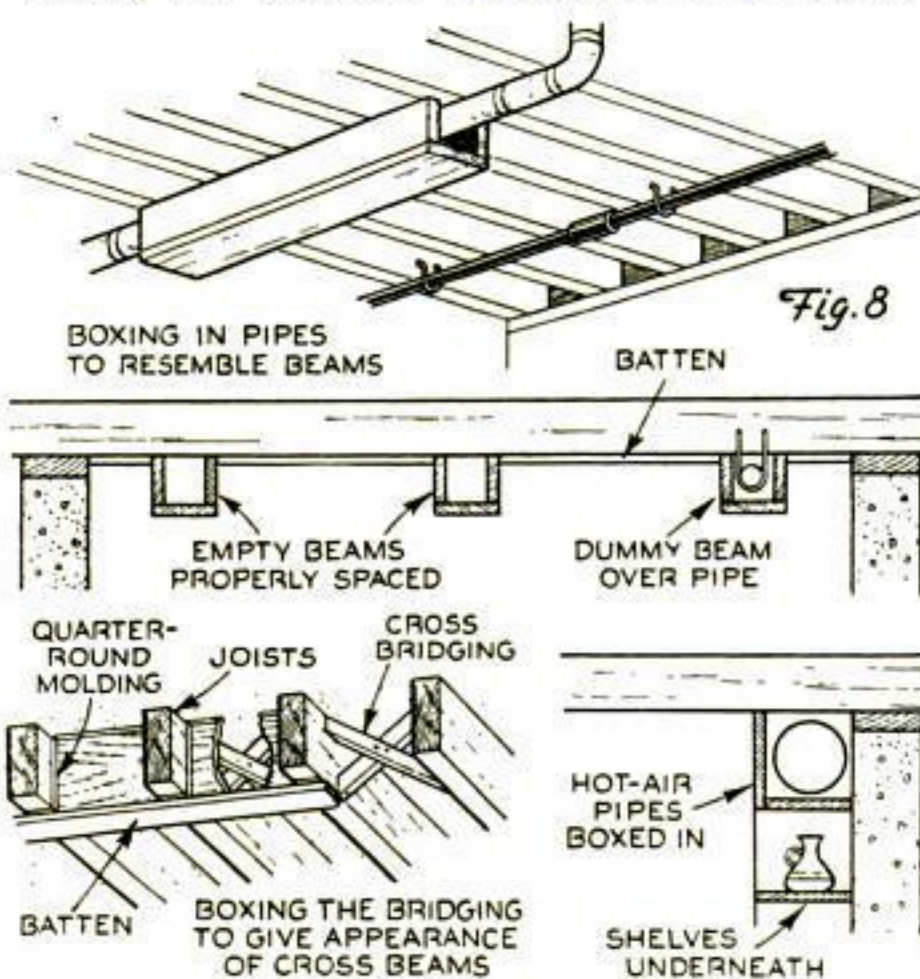


Fig. 7

Design for a cellar fireplace. In an old house, the flue can be carried up outside



Pipes and ducts should be boxed in if possible, and the rough cross bridging hidden

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Cracks can't be hidden, even when a stipple finish is used, by covering them with cloth

## Your Painting Questions

(Continued from page 78)

setting too fast. Work from the opening toward the solid portion with each application of plaster so as to pack it in tight. Let dry hard, then cut down level with the wall by using No. 1/2 sandpaper backed up with a smooth block. Do not cover the cracks with strips of cloth because these will show even when covered over with a thick coat of stippled finish, as illustrated above.

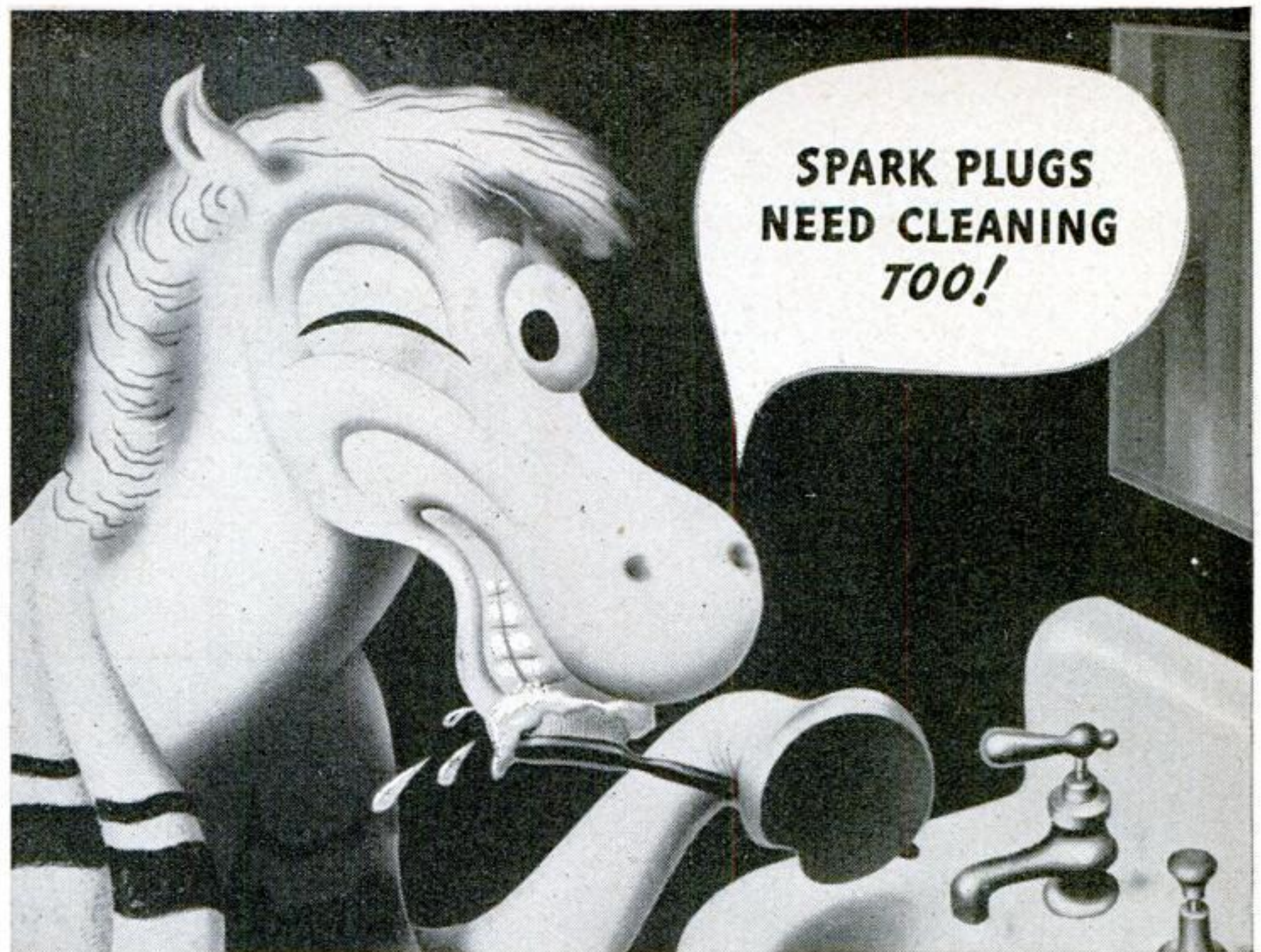
**Q** Now that we have remodeled our cellar and installed an oil burner, we should like to know how to treat our cellar walls to make the basement bright.

**A** If your walls are poured cement or cement blocks, go over them with patching plaster and close up all noticeable holes and cracks. Dry and sand down level. Use a stiff broom to brush down all surfaces after patching. Provided the basement is well aired, a washable calcimine can be used with a minimum of expense.

If, however, the walls have a tendency to be damp in summer, do not use any kind of water paint or an obnoxious odor will develop. Under these conditions apply a coat of eggshell-gloss wall paint, preferably with a motor-driven compressor and spray gun since this will do an almost perfect job in one coat. Otherwise, even if a 6-in. wall brush is used very carefully, two coats may be necessary to cover adequately the first time the basement is decorated.

**Q** Please tell me how to remove a high-grade synthetic-resin varnish from linoleum. The varnish is the type that is wiped on rather than brushed.

**A** If this is an inlaid linoleum, a standard varnish remover will be satisfactory. Lay this on with a single brush stroke in only one direction. Clean off with steel wool and denatured alcohol. Wash clean with rags soaked in alcohol. If the floor covering is a printed pattern, you cannot use a remover because it would not only take off the varnish, but the design as well.



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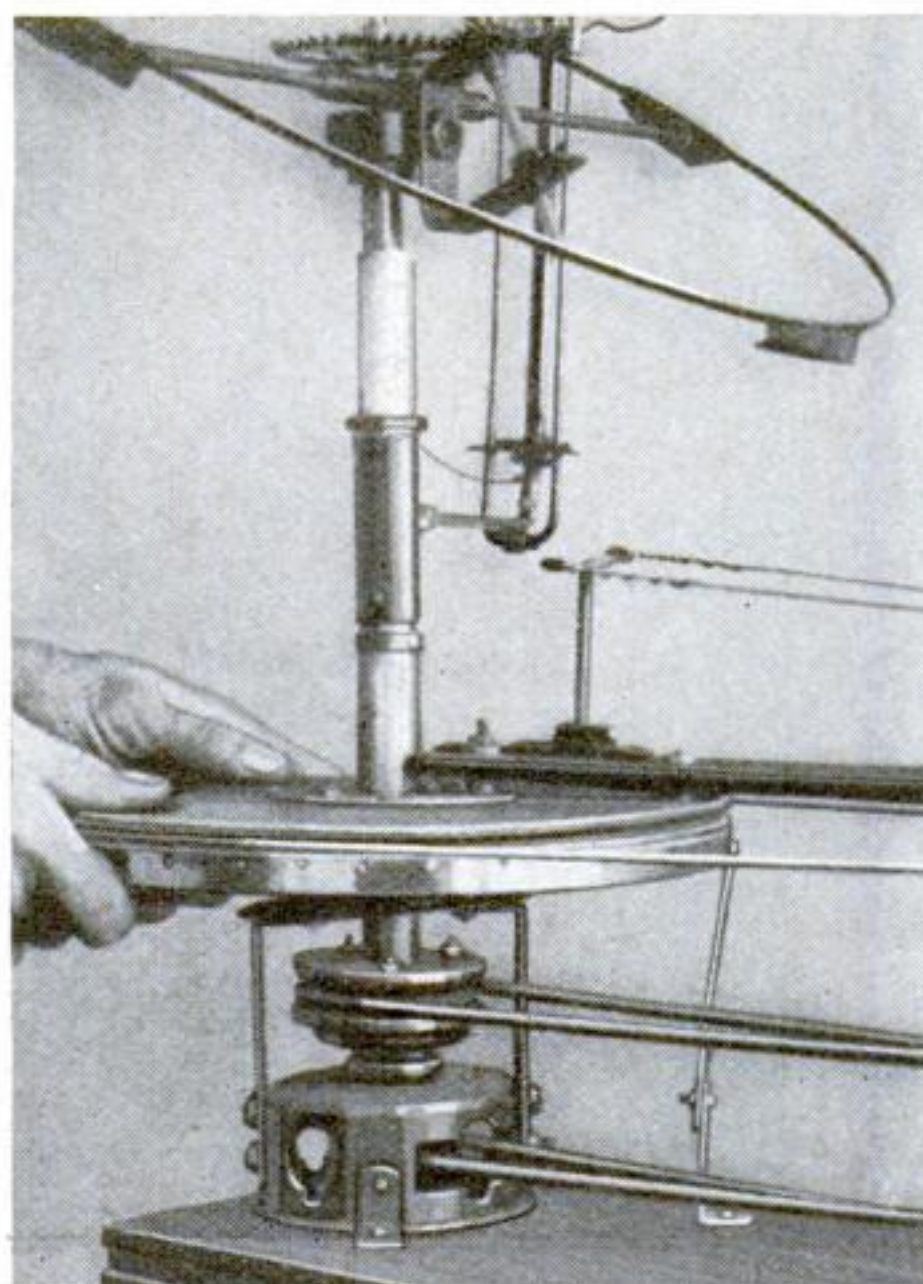
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## Making an Earth-and-Moon Model

(Continued from page 92)



A metal band is tacked around the lower edge of the large pulley to form a contact

the pipe is a reducing T-cap through which a hole is drilled to allow the rod to rotate freely, yet without play.

Encasing pipe 9 is a drapery-rod tubing (10) with a wooden pulley (13) fastened to its base, which in turn rotates freely on a ring washer resting on the fuse box.

A sturdy  $\frac{3}{4}$ -in. U-shaped metal strip (17) has a hole for tubing 10 to pass through, and this strip acts as a base for the largest pulley (12), which is a 9-in. grooved wooden disk.

The sun's reflector is lined with dull black paper. The 18-volt bulb, when used with a 10-ohm rheostat connected with a toy transformer, shows the ever-changing shades of day and night.

Sewing-machine belting turns the two lower sets of pulleys, while a plain cord, with a coil spring for tension, turns the upper pulleys.

The hollow earth is punctured at the north and south poles. A curtain-rod tube  $2\frac{3}{4}$  in. long is soldered to the south pole, and at the other end of the tube is soldered the small gear of an egg beater. The earth's axis extends from the north pole through and below this tubing.

To save space, the following is both a key to the drawings and a guide in selecting suitable materials:

1. Tin globe.
2. Axis of globe,  $\frac{1}{4}$ -in. curtain rod.
3. Curtain-rod tubing.
4.  $\frac{3}{4}$ -in. flat metal bent to  $23\frac{1}{2}$  deg., with holes for axis of earth.
5.  $\frac{1}{4}$ -in. curtain rod.
6. Large egg-beater gear.
7. Small egg-beater gear.
8. Reducing T-cap with hole in top for rod 5.
9.  $\frac{3}{8}$ -in. pipe threaded into top of fuse box 16.
10.  $\frac{3}{4}$ -in. curtain-rod tubing.
11.  $\frac{7}{8}$ -in. curtain-rod tubing.
12. Wooden pulley, 9-in. dia., resting on ring washer.

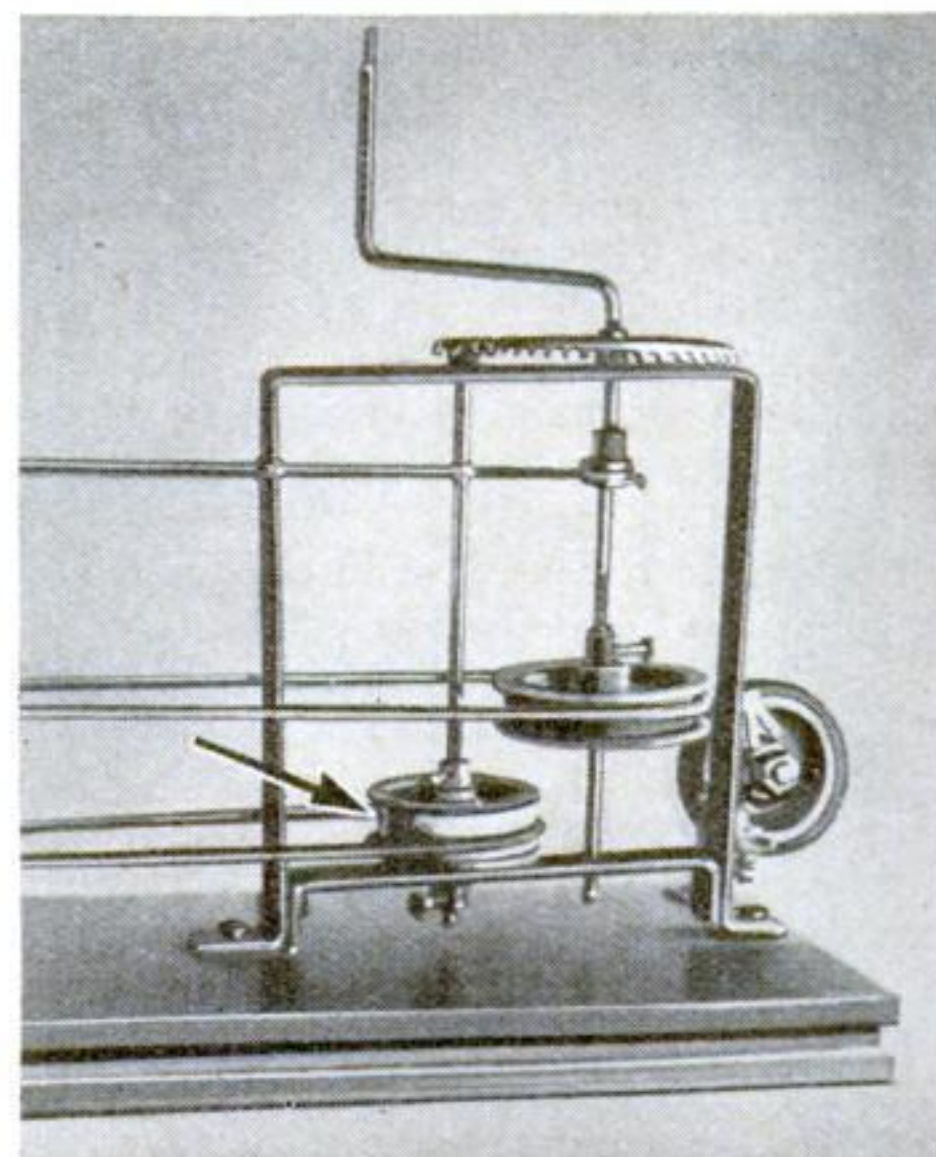
13. Wooden pulley,  $2\frac{1}{2}$ -in. dia., fastened to base of tubing 10.
14. Metal band tacked around bottom edge of pulley 12.
15. Flexible metal for electrical contact with band 14.
16. Fuse box fastened securely to base-board.
17.  $\frac{3}{4}$ -in. flat metal which supports pulley 12.

### QUESTIONS THE MODEL HELPS TO ANSWER

1. Why do spring and summer have seven more days than fall and winter.
2. What is the vernal equinox?
3. Why do we have four seasons?
4. What is meant by regression of the nodes?
5. Is the orbit of the moon always concave to the sun?
6. Why does the sun set only once a year in the polar regions?
7. Why does the moon appear to travel from east to west when actually it is traveling 13 deg. eastward each day?
8. Why does the moon appear to revolve completely in  $29\frac{1}{2}$  days when it requires but  $27\frac{1}{3}$  days?
9. Why does the "Man in the Moon" appear upside down to some persons?
10. Why do we have colder weather in January when the sun is 3,000,000 miles closer to the earth than it is in July?
11. Why isn't the moon always full?

18. Metal pulley, 1-in. dia.
19. Flat electrician's "fishing" wire.
20.  $\frac{1}{4}$ -in. pipe  $3\frac{1}{2}$  in. long.
21. Curtain rods 6 in. long.
22. Wire helping to support moon's arm.
23.  $\frac{1}{4}$ -in. curtain rod  $7\frac{1}{2}$  in. long.
24.  $\frac{3}{16}$ -in. curtain rods.
25. Curtain-rod tubing 11 in. long with  $\frac{1}{4}$ -in. slit lengthwise.
26. Metal triangle to keep uprights in place.
27. Roller.
28. Roller's axle, fastened to 29, 30, and 31.

(Continued on page 113)



The pulley grooves are padded with tape to provide the required number of revolutions



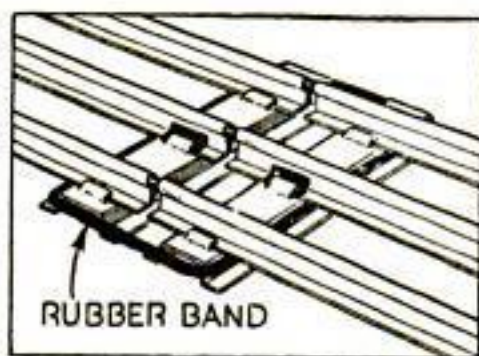
## Earth-and-Moon Model

(Continued from page 112)

29. Lugs, which rise and fall on rods 24.
30. Wire guide; slides in slit of tubing 25.
31. Stiff wire to support moon.
32. Cork moon.
33. Hardwood arm 26 by 1¼ by ¼ in.
34. Wire, helps to support sun's arm.
35. L-brackets.
36. 3/16-in. curtain rods.
37. Base of cocktail shaker with 3¼-in. opening.
38. Nuts for adjusting to proper level.
39. Bulb for sun, 18 volts.
40. Base and top of old flash light.
41. Wire leading to contact on pulley 12.
42. Large gear of ordinary egg beater, 2¼-in. dia.
43. Small gear of egg beater, ⅝-in. dia.
44. Rigid U-shaped metal frame fastened to baseboard.
45. Sun's pulley, ⅝-in. dia.
46. Moon's pulley, 2½-in. dia.
47. Earth's pulley, 2-in. dia.
48. ¼-in. curtain rods.
49. 10-ohm rheostat.
50. Toy transformer.

## Rubber Bands Hold Toy Tracks Together

MODEL railway track of the ordinary tin-plate type may be prevented from coming apart between sections by the simple expedient of slipping a rubber band around the end ties as shown in the accompanying sketch.—MORTON COSMAN.



## Spring Clip on Mail Box for Outgoing Letters

AN OUTGOING letter sometimes has to be left at a house mail box for the letter carrier to pick up the next time he calls. If it is placed inside the mail box, he may not notice it, and if it is merely shoved halfway into the slot, it may become dislodged or be lost.

A simple solution is to place a spring clip of some type on the side of the letter box. This may be simply a piece of spring brass, bolted on and bent to hold the letters. If the mail box is not exposed to the weather, an ordinary spring stationery or binder clip may be used, but it is best to enamel the steel so it will not rust and leave stains on the letters. In an exposed location, a spring wooden clothespin is better. It may be painted the same color as the letter box. If the mail box is down low, be sure to place the clip so it will not catch on clothing.—MORRIS KATZ.

## Repairing Coaster Brake

A BICYCLE coaster brake that was so worn it would not stop the wheel was made to give active service again at no cost by inserting a piece of clock spring 0.015 in. thick between the clutch and the outer shell. This ring-shaped steel shim holds itself in place and takes up the extra space caused by wear.—WALT MESSENGER.

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"When I reached the man he was about done for. As I battled the undertow to bring him in, he slipped from my grasp and sank.



"Together, Disney and I brought the body ashore, and then...

"With the glow of the flashlight on that cold, pallid face that seemed stilled forever, we tried artificial respiration ... and it worked! If ever a man was saved by the faithful performance of fresh DATED 'Eveready' batteries, this man was.

(SIGNED) Ernest Saftig



"In the darkness I couldn't find his body. Then Disney gave me his flashlight, and because it kept burning, I was able to locate the victim by diving.



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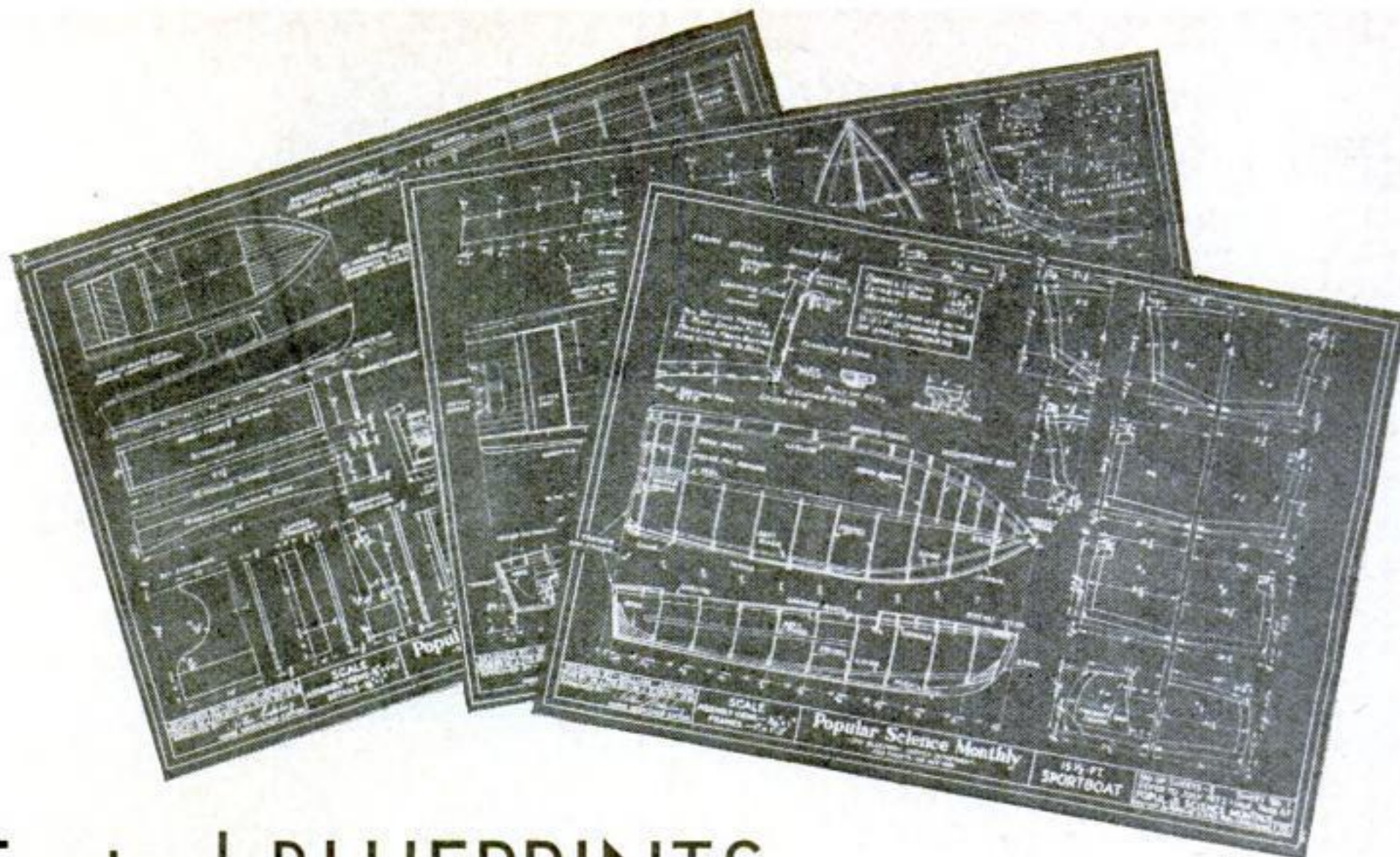
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{ Construction kits are available for some of these models. See page 22. }	



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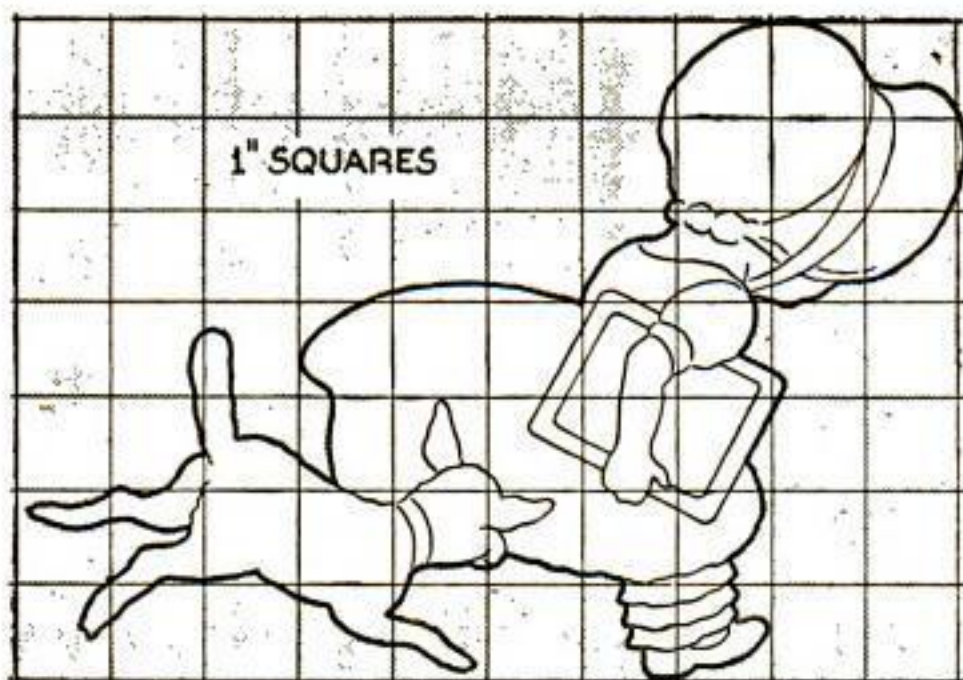
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## Child's Sewing Cabinet

(Continued from page 75)

place to which to fasten Mary and the lamb. Four nails are set into the curbing to hold spools of thread. The lamb's tail holds the thimble.

The whole should be painted in bright colors. The schoolhouse can be red with the window panes colored blue. The tile roof may be green, orange, or white. Mary's dress is bright orange with blue and black figures. The lamb is white and has a pink ribbon around its neck. The sidewalk is painted white with black lines for the joints between the stones.—D. C. MARSHALL.

## Small Occasional Table

(Continued from page 74)

three-ply, a piece of solid walnut is best because the edges are exposed. If, however, veneer is used, the edges may be faced with strips of thin walnut. The top may be nailed on if the nails are placed where they will be hidden by the gallery rail. Small angle blocks, glued to the underside of the top, serve to make the construction more rigid.

The gallery rail, marked *I*, should be carefully mitered at the corners before the design is cut out so the spacing of the design may be adjusted uniformly at ends and sides. Assemble the rail with glue and nails, set it in place, and drive a few nails into the table top after drilling holes. The ornamental brackets are then sawed out and glued and nailed in place.

After the nail holes have been filled and the whole table sandpapered, the wood may be stained, filled, and varnished, or given any desired type of finish.—F. CLARKE HUGHES.

### LIST OF MATERIALS

No.	Description	T.	W.	L.
24	Leg parts <i>A</i> and <i>B</i>	$\frac{3}{8}$	$1\frac{1}{8}$	4
16	Leg parts <i>C</i> and <i>D</i>	$\frac{3}{8}$	$1\frac{1}{8}$	$1\frac{3}{4}$
4	Head blocks <i>E</i>	$1\frac{3}{8}$	$1\frac{3}{8}$	$3\frac{1}{8}$
8	Brackets <i>F</i>	$\frac{1}{4}$	3	3
4	Banding <i>G</i>	$\frac{1}{4}$	$\frac{1}{4}$	16
1	Top <i>H</i>	$\frac{3}{8}$	$12\frac{1}{2}$	16
4	Railing <i>I</i>			
	(see detail)	$\frac{1}{4}$	$1\frac{1}{4}$	16
4	Side rails <i>J</i>			
	(see text)	$\frac{1}{2}$	$3\frac{1}{8}$	15
12	Leg strips <i>K</i>	$\frac{3}{8}$	$\frac{3}{8}$	24
4	Base blocks <i>L</i>	$\frac{7}{8}$	$2\frac{1}{4}$	$2\frac{1}{4}$

NOTE: Dimensions are given in inches. All stock is walnut except the head blocks *E*, which are white pine.

# The Friendly Blend

IN 1904 . . . "It was 34 years ago that I went over to 'Pop' Smith's place to help him clear out his woodland. I can remember it just like yesterday. That first evening, after he'd walked me down to the end of the lane and wished me 'good night,' he handed me a corn-cob pipe and a package of UNION LEADER—'for company!' he said."



## Then...and Now

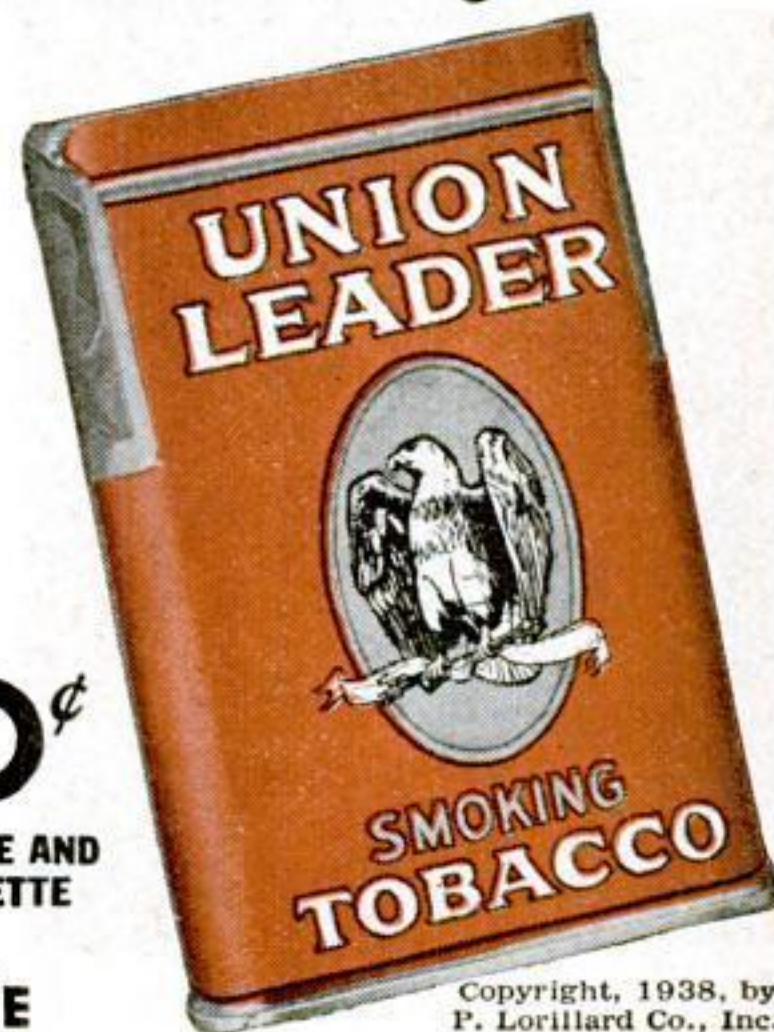


TODAY . . . "Since that day, I've found UNION LEADER is always mighty pleasing company. On my own farm, out by Milo Center, I now have three grown sons, all of them smoking UNION LEADER like me. Looking back, I can recollect some skimpy years when crops weren't so good—but I've always been able to feel pretty rich just by lighting up my pipe."—Benoni Sisson, R.F.D. Milo Center, Penn Yan, New York.

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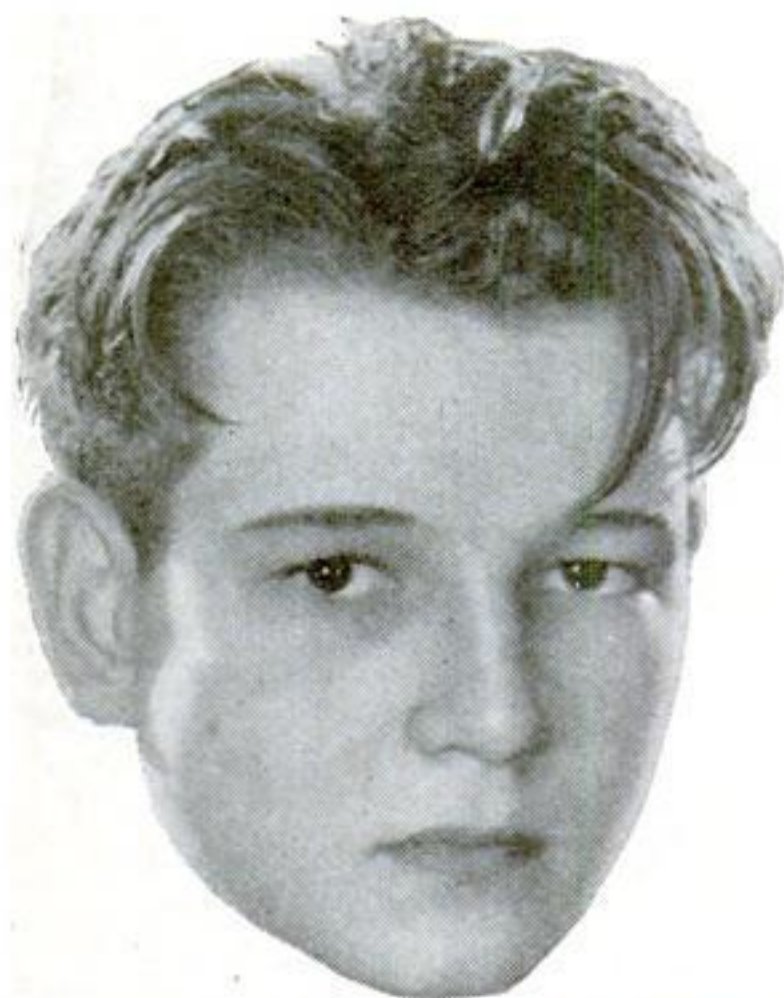
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**Glostora**



More than 500 toys were constructed by the Nanticoke (Pa.) Club during the past year

## Guild Helps Its Clubs

*(Continued from page 87)*

State Armory on the second Wednesday of each month . . . "A Practical Cover to Save Books" was discussed by George Sogge at a meeting of the Stout Arts and Crafts Club, *Menomonie, Wisc.* William Christensen spoke on "Wood Turning as a Hobby." . . . The *Hudson (Mass.)* Craftsman Club is constructing a model house to scale.

A year of brilliant achievement is assured the *Rockford (Ill.)* Homecraft Club with the election to office of three men who helped organize the National Homeworkshop Guild in 1933 and were among its original officers. LeVern T. Ryder has been named chairman of the local club; Robert A. Horner, vice chairman, and E. Raymond DeLong, secretary. They were originally president, vice president, and secretary of the national organization. Other officers of the Rockford club are E. J. Davis, treasurer, and F. C. Burritt and R. G. Alcock, directors.

Projects being constructed by members of the Bushwick Homeworkshop Club of *Brooklyn, N. Y.*, include the following: photographic enlarger, toy chest and cabinet, chemical balance, and Colonial fireplace. Robert Nelson, president, exhibited a children's clothes tree he had designed and built.

The *Fairmont (W. Va.)* Homecraft Club reports that it has just concluded the best year since its organization. A total of 207 toys were made for the Salvation Army and 50 reconditioned toys sent to a local orphanage. Elaborate plans are being made for 1938, including the establishment of a large home workshop library and a varied program of talks and demonstrations. Officers are A. D. Koon, president; B. L. Bell, vice president; W. M. Hamrick, secretary-treasurer; C. H. Alexander, librarian.

Edward Morrison won a contest conducted by the Berkshire Homeworkshop Club, *North Adams, Mass.*, to see who could make the most useful article with only a hand coping saw. He constructed a combination glove and hat rack. Daniel Barton discussed ways of finishing woods. A list of home workshop questions provided amusement for the following meeting.

Through an extensive publicity campaign in local newspapers, the *Crisfield (Md.)* Homeworkshop Club was able to obtain a great many broken toys, which are being repaired and given to poor

*(Continued on page 117)*

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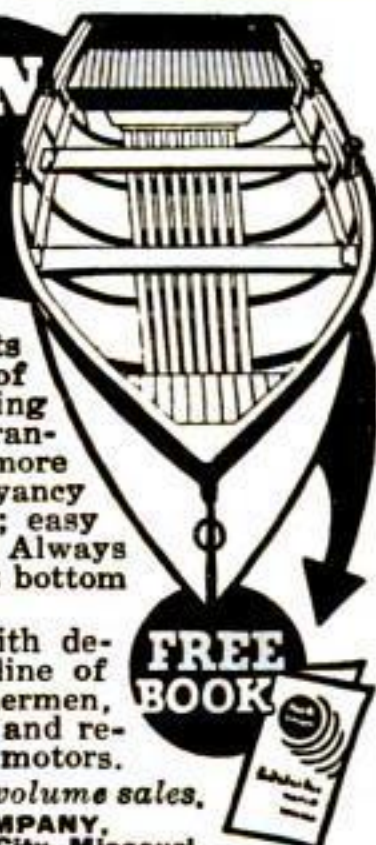
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## Guild Helps Its Clubs

(Continued from page 116)

children. The toys were collected by the Boy Scouts. Among the projects being made by members are radios, smokers, magazine rack, model airplane, radio transmitting set, and a twelve-pointed glass star lamp.

A method of making a wood turning with only a hand drill and homemade tools was demonstrated by O. B. Ray to the Vicksburg (Miss.) Homeworkshop Club. Mr. Ray used one hand to operate the drill and the other hand to hold the tool on the stock, which was walnut 14 in. long and 2 in. in diameter. Secretary T. O. Pike says that the members considered the finished product equal to turnings made on an expensive lathe.

Woodworking is being studied extensively by some of the clubs. W. T. Russell is giving a course for the Hobby



One corner of the exhibit at Richmond, Va. M. Grove-Hagan carved the wall plaques

Homeworkshop Club of Bucksport, Me. "Fundamentals of Woodworking" was the theme of a recent meeting of the Creston (Iowa) Homeworkshop Club at the home of C. H. Thomas. Wood turning was demonstrated to the Mark Twain Homecraft Club, Hannibal, Mo., by W. R. Couch, who has had thirty years' experience in that field.

"The Mining and Milling of Lead," a three-reel moving picture, was enjoyed by the Louisville (Ky.) Homeworkshop Club recently. New officers are E. J. Schwartz, president; C. R. Yester, vice president; P. J. McDonnell, secretary-treasurer. Two hundred toys were turned over to the mayor's Christmas committee.

The informal hobby show held by the Kerrisdale Homeworkshop Club, Vancouver, B.C., Canada, at the home of the president, Ian McKay, aroused considerable interest. A similar event is scheduled for the fall . . . The Topeka (Kans.) Homeworkshop Club is rearranging its shop and meeting rooms in the Y.M.C.A. . . . Henry J. Jung spoke on "Modern Trends in Furniture Design" before the Hardwood Homeworkshop Club of Neenah, Wisc. The members discussed the possibility of making toys to be given to poor children next Christmas and awarding a \$5 prize for the best toy.

Fred Sass demonstrated metal spinning at a recent meeting of the Fort Stanwix Hobby Club, Rome, N. Y.



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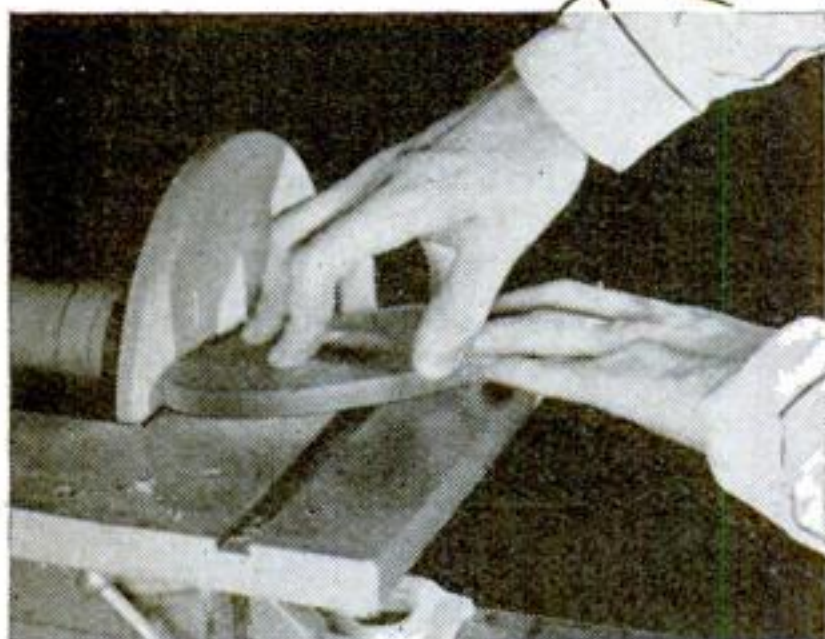
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ABRASIVE PRODUCTS



## Can the Zeppelin Come Back?

(Continued from page 31)

setback or the end of the road for the Zeppelin?

Proponents of the big dirigibles were quick to point out that fire, and not structural failure, had produced the disaster. Photographs showed that, in spite of the fire and explosions, the framework of the Zeppelin remained intact and settled slowly to the ground. It showed that it could withstand tremendous strains, far in excess of those it would meet in flight. But, so long as the fire hazard remained, the proponents admitted, the Zeppelin was doomed. Approximately half of all the big dirigibles built have been destroyed by flames. Dr. Hugo Eckener, veteran commander of the lighter-than-air ships, expressed the general opinion when he said: "We must have helium!"

UNLIKE hydrogen, this odorless, colorless gas is not inflammable. Forty years ago, when Count Zeppelin's first dirigible was under construction in its floating shed on Lake Constance, helium was a rare laboratory gas. It commanded a price of something like \$2,000 a cubic foot. If that rate prevailed today, one filling of the LZ-130 would cost more than \$14,000,000,000!

However, in the intervening years, American scientists have devised methods of washing, cooling, and separation which enable them to extract helium in large quantities from the natural gas of several fields in the Southwest. As a result, the cost has steadily declined until now helium can be obtained for approximately a cent a cubic foot. Last year, the United States Congress authorized the sale of 17,000,000 cubic feet of helium to Germany for Zeppelin use.

It will be used for the original inflation of the sixteen great cells of the airship, and for replacing helium lost during the transatlantic flights. No hydrogen will be used on any passenger Zeppelin in the future, the German officials of the airship line have decided. Only safe helium will fill the skyliners.

BECAUSE America has a virtual monopoly on the gas, German scientists have devised a number of ways for conserving their supply. Before the start of a flight, the gas will be warmed to give it its greatest buoyancy. During the trip, moisture coming from the engine exhausts will be carefully collected to balance the loss of weight as the fuel is consumed, and thus make it unnecessary to valve off gas to maintain a given altitude. By these steps, the scientists believe they will be able to conserve as much as ninety-five percent of the gas which hitherto was lost during a transatlantic voyage.

The use of helium conquers the fire hazard. But another problem will take its place. This noninflammable gas is less buoyant than the explosive hydrogen.

(Continued on page 119)

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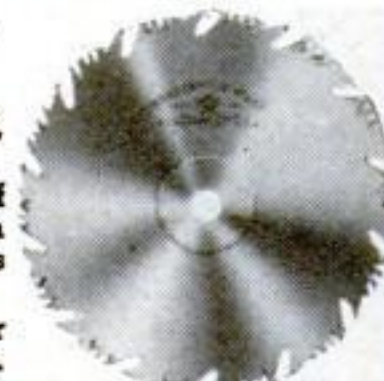
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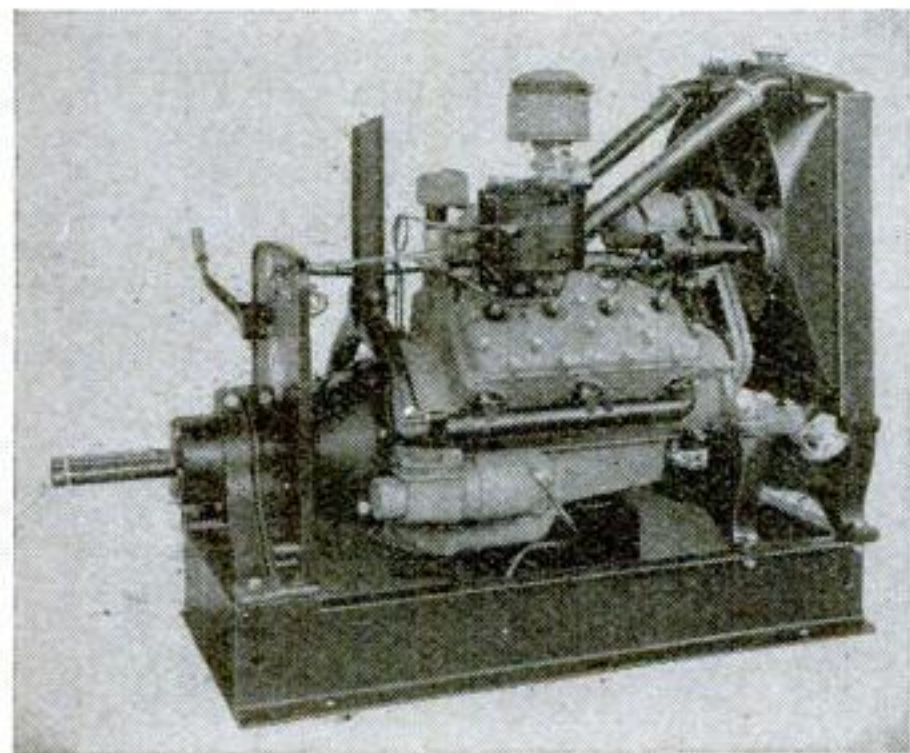


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## Can the Zeppelin Come Back?

(Continued from page 118)

It will reduce the lifting power of the LZ-130 by seventeen and a half tons. Such a loss of pay load will cut the profits which can be expected from its operation. Only by raising the rate for passengers and freight, can the income attained by the *Hindenburg* be reached by the LZ-130.

IN the course of time, with the danger of fire eliminated, lighter engines may replace the heavy Diesels which now drive the Zeppelins. This saving in weight would restore some of the pay load which has been lost. But the designer of the rigid dirigible is faced by an ever-present dilemma. If he increases pay load and buoyancy, he decreases safety; if he adds to the safety of the ship, he decreases the margin of lift and the profit that can be made in operation.

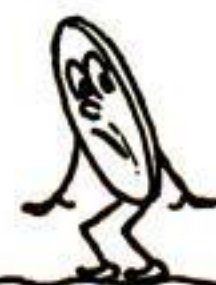
The crash of the *R-101*, paradoxically, resulted from the fact that the huge dirigible was made "too safe." The designers used a metal framework that was superstrong—and unusually heavy—to overcome the danger of structural failure. They reduced the fire hazard by employing large—and heavy—Diesel engines. As a consequence, the airship had a very small margin of buoyancy when in flight. Even a relatively slight tear in one of the gas bags would be sufficient to let out enough hydrogen to bring the ship to earth. Had the great bags been filled with helium instead of hydrogen, one authority points out, there would have been no disaster—for the simple reason that the *R-101* would never have left the ground!

AS American scientists continue their researches and as the flying cigars of the Germans once more return to the transatlantic run, the world is watching to see what will happen. On the side of the Zeppelin, there are many attractions. The rigid dirigible can lift immense loads; it can travel great distances without refueling; it is able to float in the air while engines or controls are being repaired. In these respects, it has the advantage over the airplane. On the other side of the ledger, however, are the disadvantages. A leaking gas compartment may mean disaster; unless an abundant supply of helium is available, fire and explosion are ever-present dangers; and, finally, only at elaborately equipped fields where mooring masts are available can these aerial giants come down in safety.

On the day following the burning of the *Hindenburg*, a syndicated cartoon appeared in many American newspapers. Labeled "The Future of the Dirigible," it showed the smoldering ruins of the Zeppelin with smoke curling into the sky above it to form a great question mark. That question mark remains. Only the future can give us the concluding chapters in the story of Count Zeppelin's dream.

## Treet Topics

TO MAKE A  
THIN DIME



LOOK LIKE  
A FAT  
QUARTER

AND TO MAKE YOUR  
FACE LOOK  
AND  
FEEL  
LIKE



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TO A PACK OF  
PERFECT  
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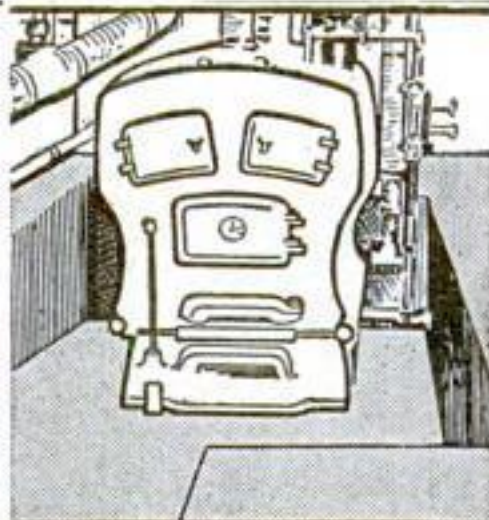


## WET CELLARS MADE DRY from the Inside!

DAMP musty cellars are unsanitary, a danger to health and a poor place to store valuable material.

Where ground water or moisture seep in through cracks or porous spots in the floor or walls, you can make and keep your cellar dry and sweet—a fit place to work, free from odor, mold and rust—by filling the cracks and coating the moist surface with Smooth-On No. 7.

This is the one practical water-proofing that you can apply yourself, easily, from the inside, to wet or dry surface and with every assurance of thorough water-tightness, even in the wettest seasons.



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Specifications, working directions, diagrams, and typical examples of what may be accomplished will be found in the Smooth-On Home and Auto Repair booklet.

This booklet will also show you how an astonishing number of ordinary household repairs may be made easily with big savings in each instance.

Get the booklet by returning the coupon and get Smooth-On No. 7 in 1 or 5-lb. can or 25 or 100-lb. keg from your supply house or from us. About 25 lb. required for each 100 sq. ft. of surface covered.



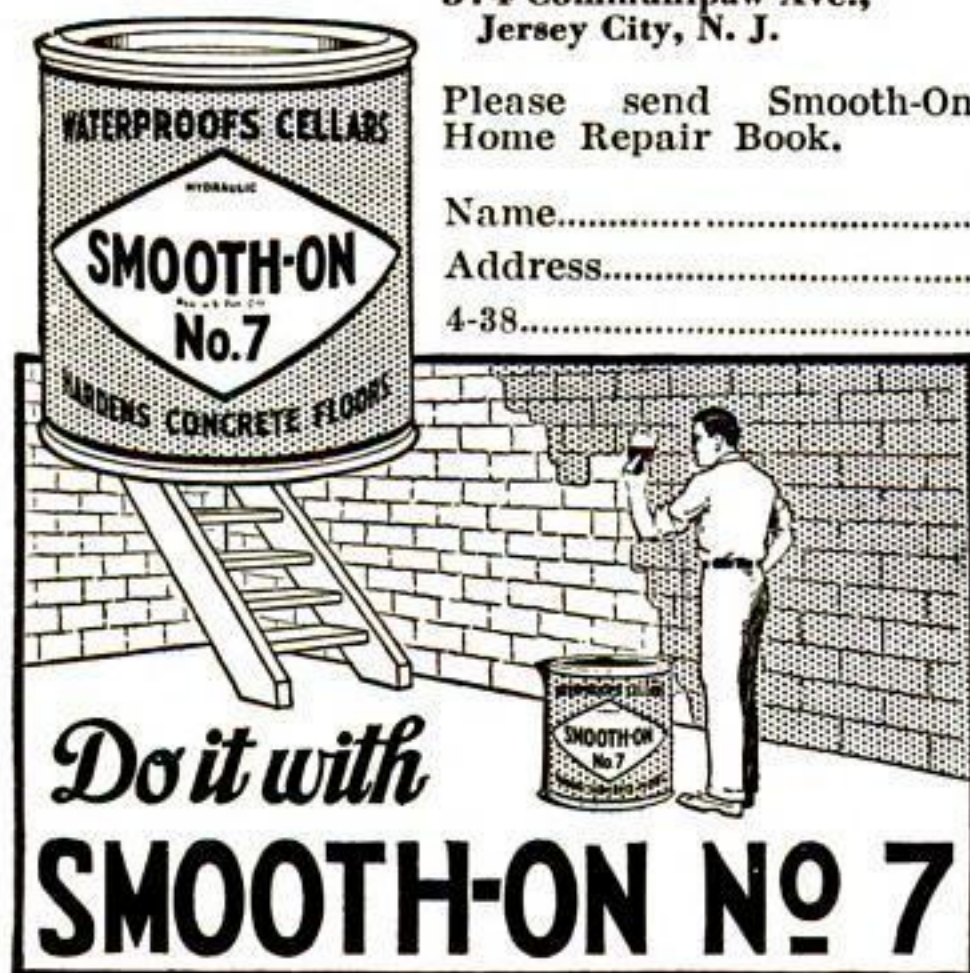
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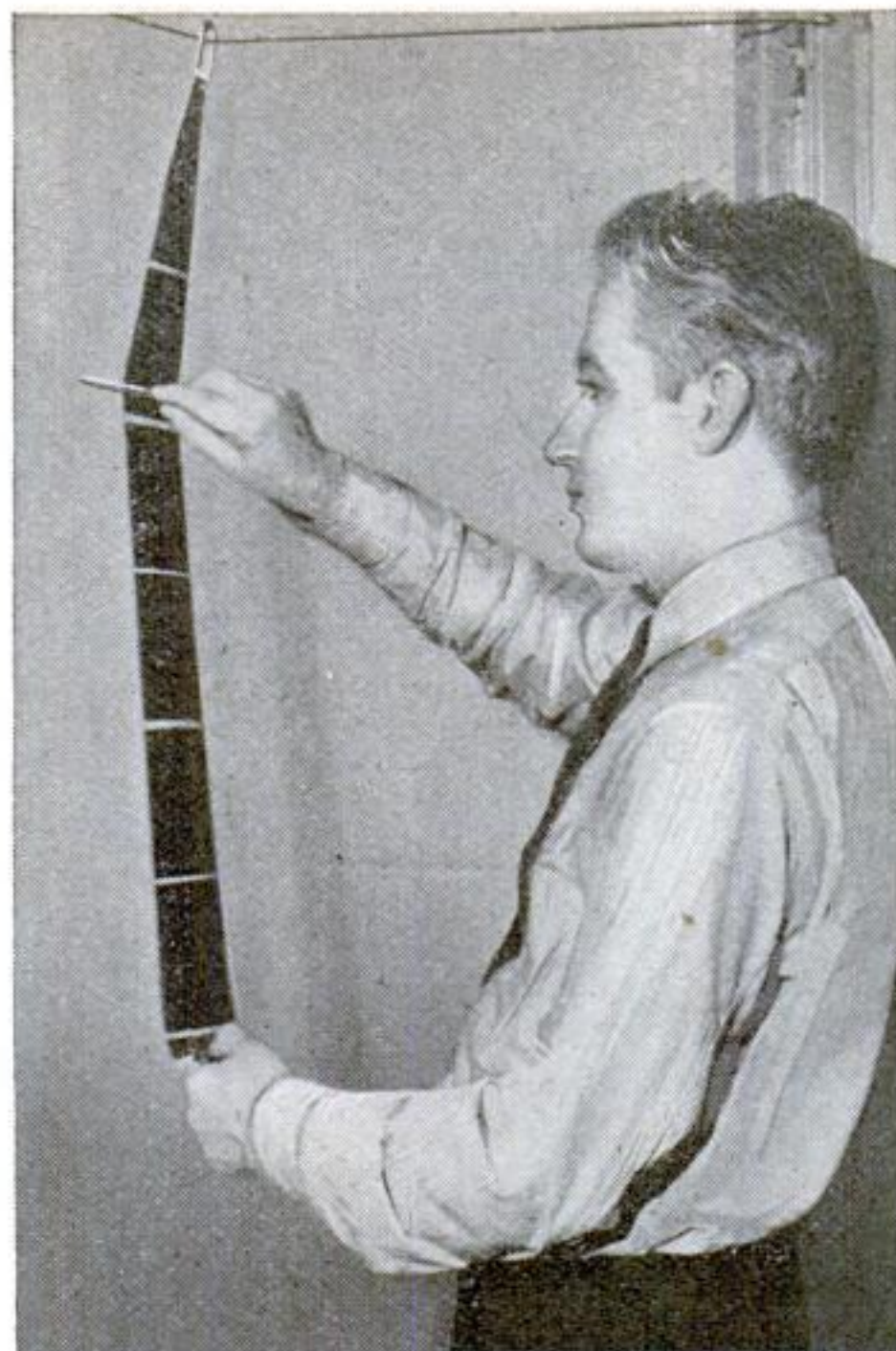
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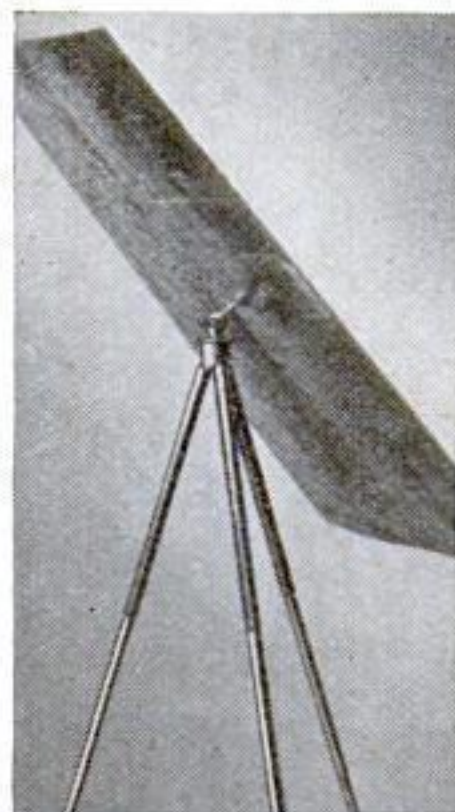
## Windshield Wiper Used as Film Squeegee

IF PHOTOGRAPHIC film is allowed to dry without first removing most of the surface water left from washing, the emulsion will dry unevenly, and permanent markings known as water spots may be left. To prevent this, some amateurs wipe the film with a damp wad of cotton wool, a piece of chamois, or a cellulose sponge. Cotton sometimes leaves lint, however, and any of these materials may pick up grit.

A substitute, which has already found its way into a number of commercial photo-finishing establishments, is a soft-rubber windshield-wiper blade, obtainable for ten cents. Such a blade will remove excess moisture from the film, and it may be kept scrupulously clean.

With roll film, the wiper is merely brought down squarely but gently on both sides of the film for its whole length. With cut film or film-pack negatives, the negative should be laid on a clean sheet of glass. Holding the negative down by one corner, first squeegee one side, then the glass, finally the other side. The wiper may be held between the fingers, or a metal handle may be added.

## Adjustable Reflector for Photo Portraits



A DOUBLE-PURPOSE portrait reflector that will often enable one photoflood lamp to do the work of two may be assembled from a sheet of building board or heavy cardboard, about 2 by 3 ft., and an extra camera tripod having a (Continued on page 121)

## FOR MEN WHO Love Fishing



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## Adjustable Reflector

(Continued from page 120)



Tripod reflector in use. Data: One No. 1 photoflood in reflector. Superpan film, 9 by 12 cm. Exposure, 1 second at F/16

swivel top. One side of the reflector should be painted a flat white; the other, covered with tin foil obtained from film wrappings. Drill a hole through the center of the board and secure it to the tripod top with a nut and washers.

In use, the reflector is placed on the side of the face opposite the lighting unit (see P.S.M., Feb. '38, p. 112). By adjusting the angle and the distance of the reflector, the precise degree of illumination of the shadows desired may be obtained. For general portraiture the white side of the reflector should be used. For special work where harsh lighting is desired, or the mottled effect of reflections from water, use the tin-foil side.

## Prepared Paper Tests Strength of Hypo

WHEN the amateur photographer's hypo or fixing solution loses its strength, the prints or films will not be entirely fixed in the usual time and they will be likely to turn brown with age. A simple method of testing the strength of the solution is by means of prepared



Upon being dipped into the fixing solution, the test strip should lose its yellow color

paper strips. Soak unexposed and undeveloped printing paper in potassium iodide solution (the room need not be dark) until it is yellow; then wash and dry it. Cut the sheet into strips, and dip a part of a strip into the suspected solution. If the yellow color is not removed in the usual fixing time, you may be sure that the hypo solution is worn out and should be discarded immediately.—KENNETH MURRAY.



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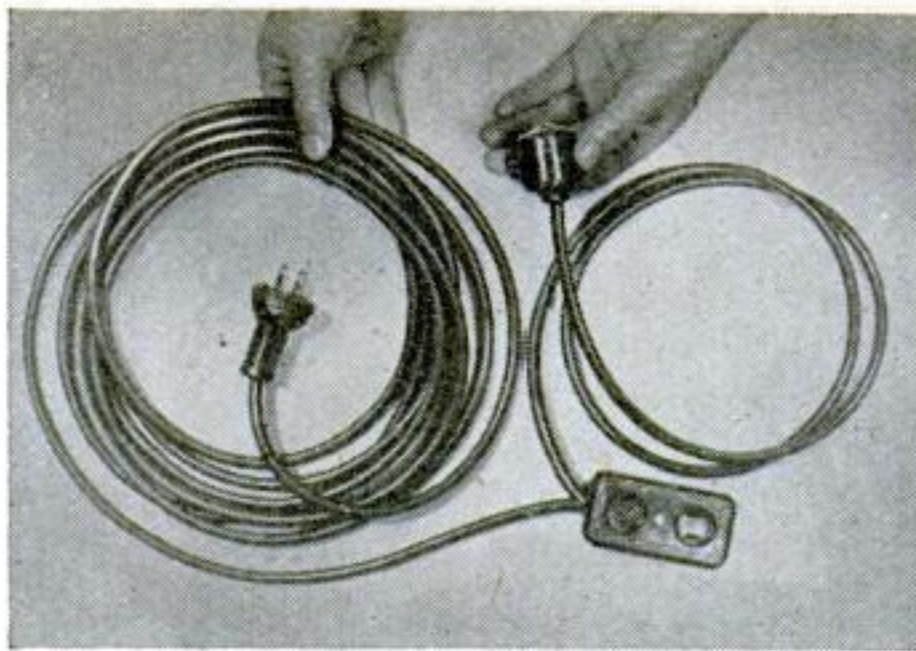
Outstanding features of the new ARGUS Model C are:

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Write for complete literature on the new ARGUS Model C and inspect it at your nearest ARGUS dealer.

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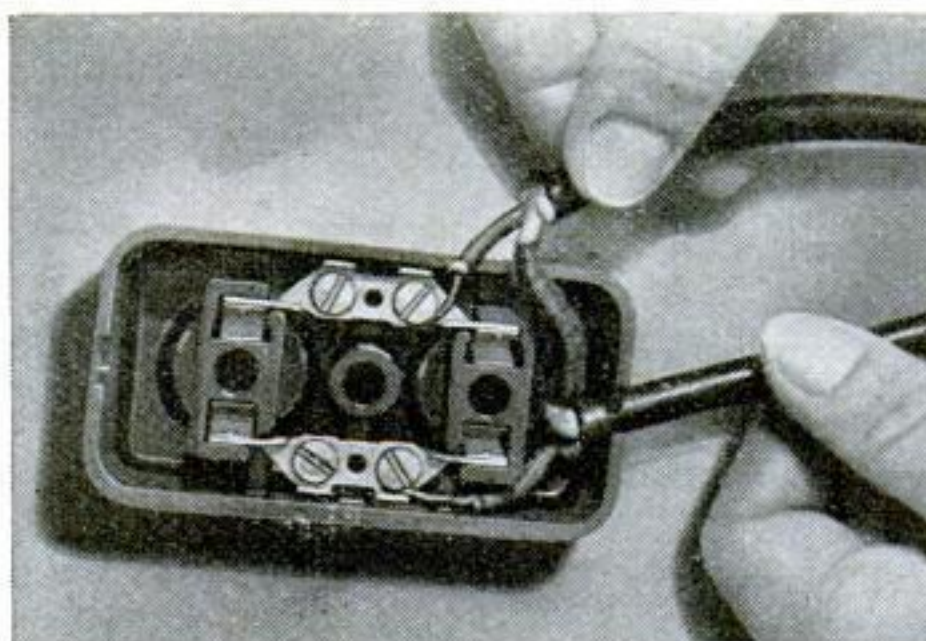


## One Switch Controls Set of Photo Lights

FOR doing photographic work inside or where lights are used, it is often necessary to have more than one outlet into which to plug the different lighting units. To control the lights conveniently and keep them from burning too long before and after exposure, I use an extension cord and double outlet box with one pendent switch control, as shown.

If more than two lights are required, another double outlet can be added to the first with a cord of any length to suit one's need. When the occasion arises, this equipment may also be used to set off photoflash bulbs.

A hole, of course, will have to be drilled in the outlet to accommodate the two wires. One of the photos shows how to wire the switch and extension cord into outlet. To add another outlet, break the wall at the other end. A plate covers the bottom.—ROBERT PUTZER.



Back of the double outlet box, showing how the switch and extension cord are wired in

## Melted Wax Crayons Fill Cracks in Linoleum

CRACKS in linoleum, especially if it has a modern pattern, can be concealed so as hardly to be noticeable by filling them with wax crayons. Choose colors to match the pattern, and melt the crayons with a lighted match so the wax will drip into the cracks. Then polish the spot to blend the colors into the linoleum.—JAMES F. SCHINDLER.

## Model Railway Cars Lettered Neatly with Gold Ink

FOR gilt lettering on model railway cars, try gold ink, which may be purchased at large stationery stores. It is applied with a pen. The finished work may be preserved by applying a thin coat of varnish after the lettering has dried thoroughly.—ARTHUR L. D. FORD.

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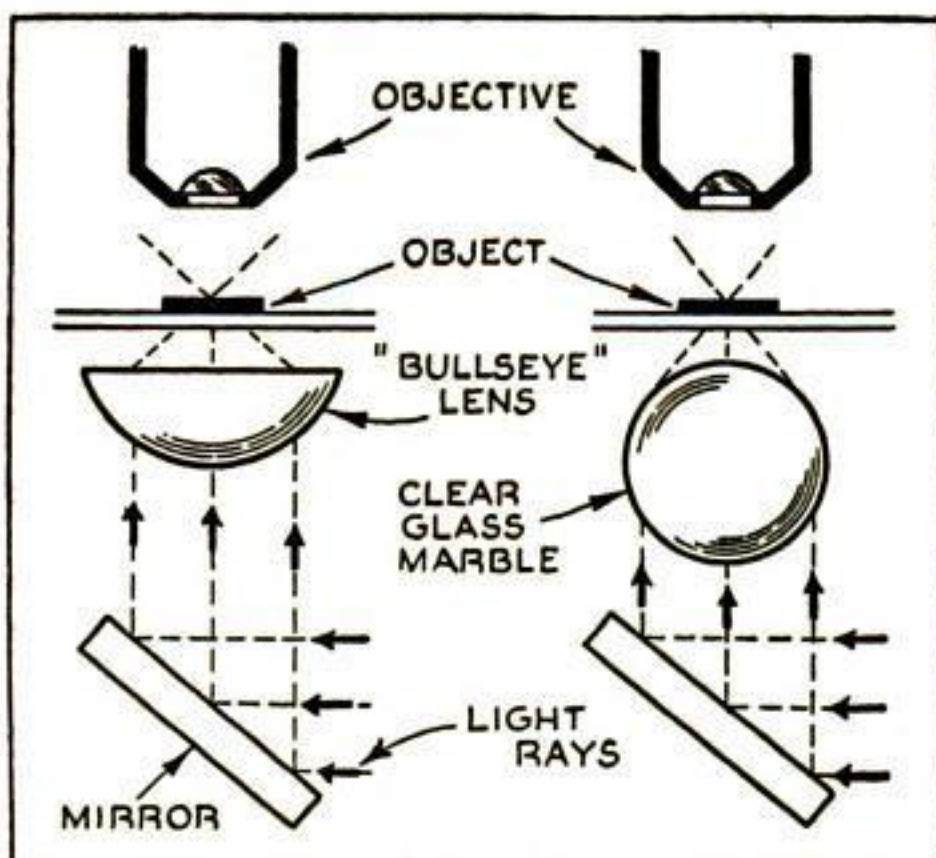
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**Get only a GENUINE DELTA**





How a flash-light lens or a clear glass marble acts as a condenser to concentrate light

## Short Cuts for the Microscope Amateur

(Continued from page 95)

and other delicate plant and animal tissue. The lacquer sets quickly and has a favorable index of refraction. Passing through high-strength alcohols is unnecessary, which is a distinct advantage with delicate specimens that shrink easily. Tissues are carried through various grades of alcohol in the usual manner, to 85% or 90% strength. Then they are transferred to lacquer thinner, which clears them and removes any remaining water. From the thinner, the specimens are transferred to the lacquer.

As a suggestion, tissues might be dehydrated with dioxan instead of alcohol, and transferred directly to the thinner or even to the lacquer itself, with a considerable saving of time.

You will find ordinary varnishes (preferably the quick-drying or four-hour types) and lacquers excellent for building shallow cells on a spinning table, and for ringing cover glasses to improve their appearance and seal their edges. Various colors can be used to dress up the slides.

**A**MONG the newer sources of illumination of interest to microscopists are the new silvered lamps designed for use with bowl-type indirect-lighting fixtures. These are standard incandescent lamps with the spherical half of the bulb opposite the base silvered like a mirror and provided with a protective coating. The silvering acts as a reflector to direct the rays in the general direction of the base. One of these placed in a socket fastened to a block of metal or wood makes an excellent microscope lamp. The silver coating prevents light from passing upward toward the eyes of the observer, and at the same time directs it downward toward the microscope mirror. Since no housing is necessary, ventilation problems are solved automatically.

If electricity is not available you will find an ordinary oil lamp one of the best of light sources. Place it so that the flat side of the flame is picked up by the microscope mirror, and arrange a

(Continued on page 124)

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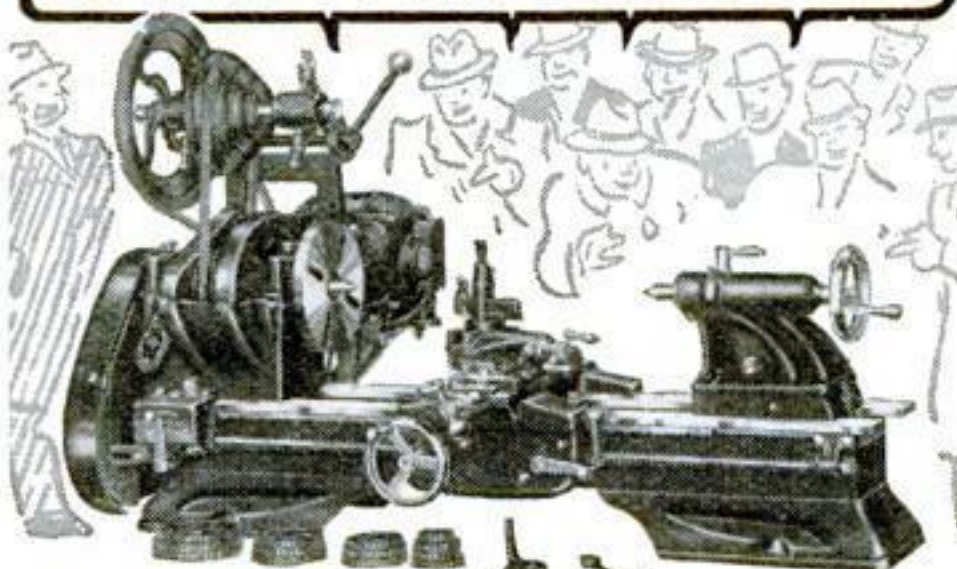
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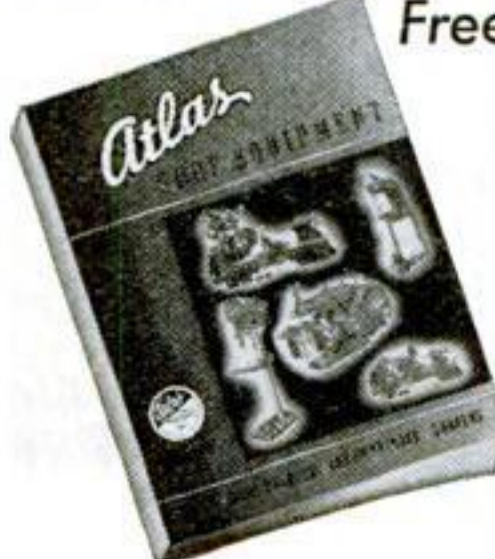
All who see the Atlas precision lathes and other shop equipment are amazed at the power, versatility, and extra features of these modern machine tools. The 10" back-geared model illustrated is \$98.50 complete with countershaft, V-belts, change gears, automatic, reversible power feeds, and many other special features.

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**Old English  
CEMENT**

## Short Cuts for the Microscope Amateur

(Continued from page 123)

shade to keep direct rays from the eyes. Because of its large area and uniform luminosity, an oil-lamp flame is superior to many newer types of light for some kinds of observation.

Did you know that a draftsman's ruling pen makes an excellent clamp for holding an insect beneath the lens of a microscope? The jaws of the pen grasp the specimen like tweezers, and are held together by tightening the adjusting screw. The pen should be mounted so that it can be revolved and moved back and forth. One way of doing this is to fasten a short length of tubing parallel to the microscope stage, and with its center line a fraction of an inch above it. Slide the pen handle inside the tube, making the fit snug enough to hold the pen in any position.

**W**OODEN forceps are handy for holding glass slides, and are easy to make. Obtain a pair of flat, thin strips of wood, like the ones physicians use for depressing the tongue, and join them at one end with a wooden or metal block tapered slightly so that the other ends of the strips press against each other. Drill holes as shown in the drawing, and attach a small screw or wooden button to the inside surface of each strip so that it will project through the hole in the other strip. By pressing the buttons simultaneously with your fingers, you force the jaws of the forceps apart to insert a slide. One button can be fashioned to form a foot, so that the forceps will rest firmly on a flat surface.

Color filters can be made by dyeing the gelatin of bleached-out photographic film. If you can obtain some undeveloped film—most photographic-supply shops have some outdated film on hand that they will give away or sell very cheaply—you can bleach it out by immersing it for fifteen minutes in a standard hypo fixing bath. Then wash it for about twenty minutes in running water.

**Y**OU can dye the gelatin coatings of the film with any of the aniline microscope stains, or with one of the various photographic dyes available. Dry, and mount in any convenient manner.

Since photographic film is damaged by heat, and may be ignited, it should be used cautiously with strong sources of light such as an arc or a projection bulb. Better for this purpose are filters made by dyeing the gelatin coatings on bleached-out lantern slides or glass-plate negatives.

Ordinary celluloid, not coated with gelatin, can be colored with dyes dissolved in alcohol and acetone, with acetone predominating. Experiment will indicate whether the results are satisfactory for microscope filters.

The action of acetone in welding together two pieces of celluloid or acetate film suggests a way of making small bell jars and other devices of use

(Continued on page 125)

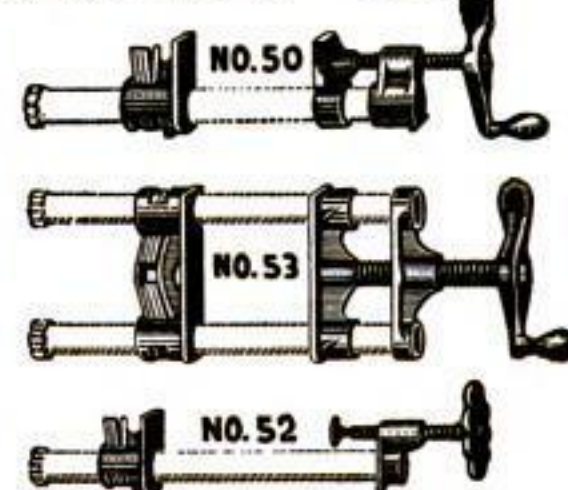
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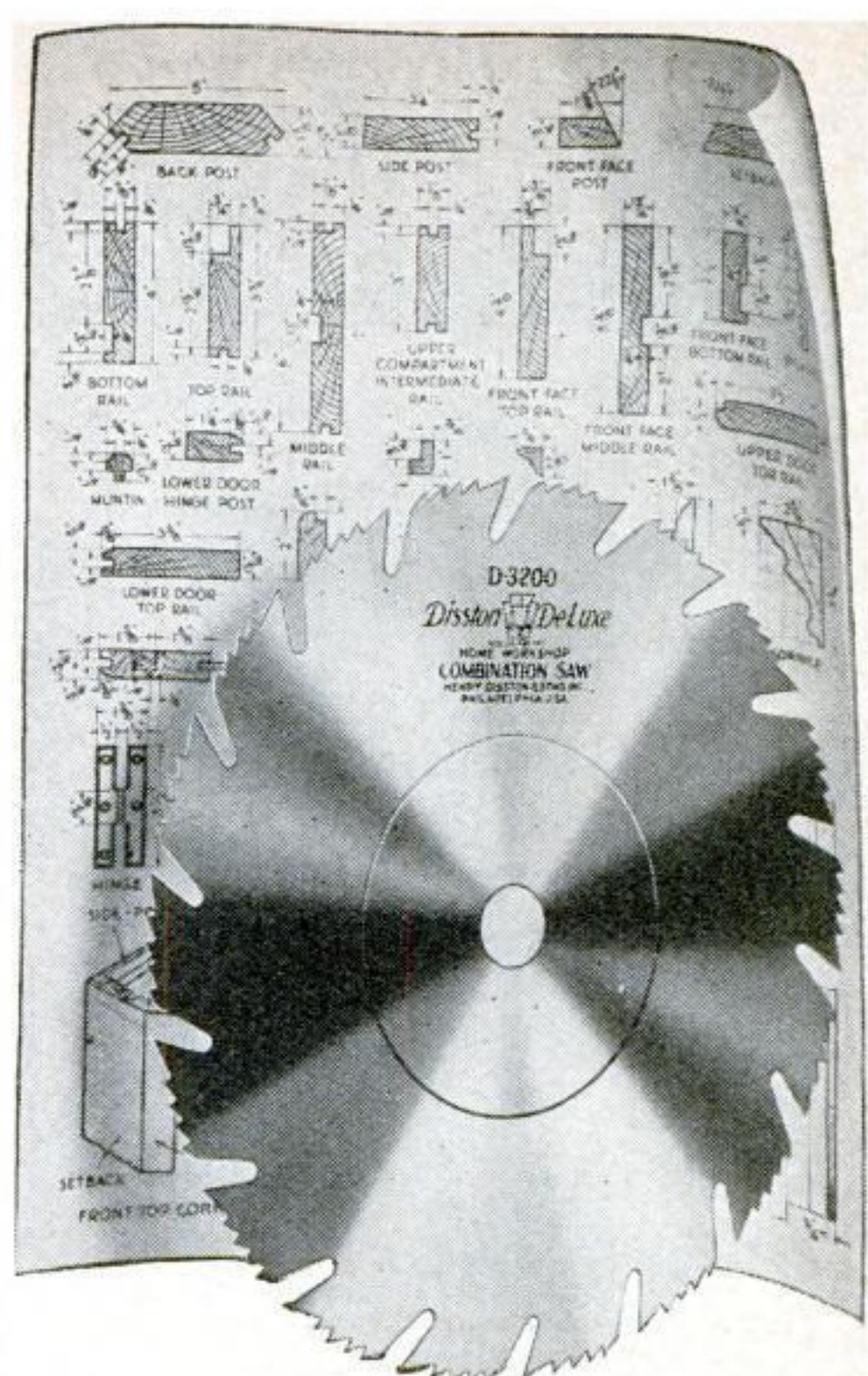
## Short Cuts for the Microscope Amateur (Continued from page 124)

in microscopy. You can use washed-off photographic film, the gelatin coating of which can be removed by immersing it for fifteen minutes in a warm bath of 5% sulphuric acid; or you can employ sheet celluloid obtainable from automobile-supply stores. Simply cut the material to the shape desired, and weld the joints and seams by holding the pieces together and placing acetone, with a brush or dropper, so that it flows between them by capillary action. The acetone dissolves the surfaces of the celluloid and permits them to weld together in a few seconds.

**T**HE work should be allowed to dry thoroughly for a day, before it can be considered permanent. Instead of acetone alone, you can employ a standard motion-picture film-splicing cement, which consists generally of celluloid dissolved in solvents such as acetone and ether. Celluloid should be employed only for articles to be used where there is no danger of their being set on fire. Cellulose acetate (safety film) is preferable to ordinary celluloid because it burns less readily. Either of the materials can be bent to permanent shapes by heating to about the boiling point of water (NOT with a flame!) to render them pliable. Hold them until cool.

Objects mounted on a glass slide may be extremely difficult to see by ordinary methods. This often is a result of the refractive index of the object being about the same as that of the mounting medium. There are various ways of making such objects—a snail's tongue for example—easier to see. One, of course, is to use polarized light, which works wonders with cellulose materials and a great many others. Another is to employ dark-field illumination. However, a simple method that often works well with the amateur microscope is to use oblique illumination. This can be produced by inserting a disk of cardboard or other object into the light beam between mirror and stage, so that only a portion of the beam passes at an angle from the mirror to the object. Larger microscopes having a substage ring for holding filter glasses and dark-field stops can be fitted with cardboard disks having holes or notches cut near the margins. Although a single hole usually is sufficient, combinations of two or more can be worked out to give various effects.

**A**ND here is a final hint for the owner of a microscope that does not have a substage condenser for concentrating light on the object: Try placing a large, clear-glass marble directly beneath the hole in the stage, so that it comes very close to the bottom of the slide. The marble, acting as a short-focus condensing lens, increases illumination. Small bullseye lenses employed on some types of flash lights can be used in a similar way.



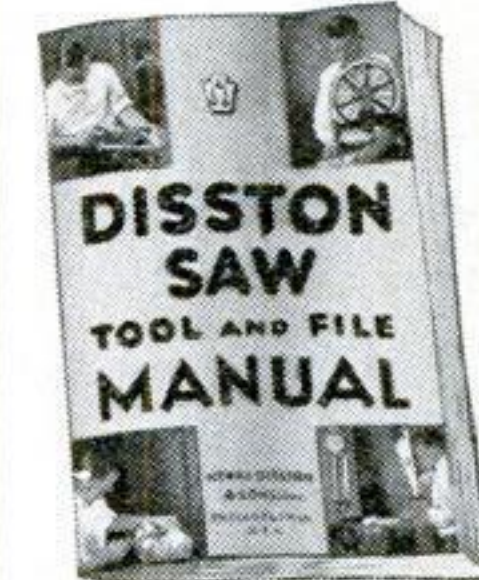
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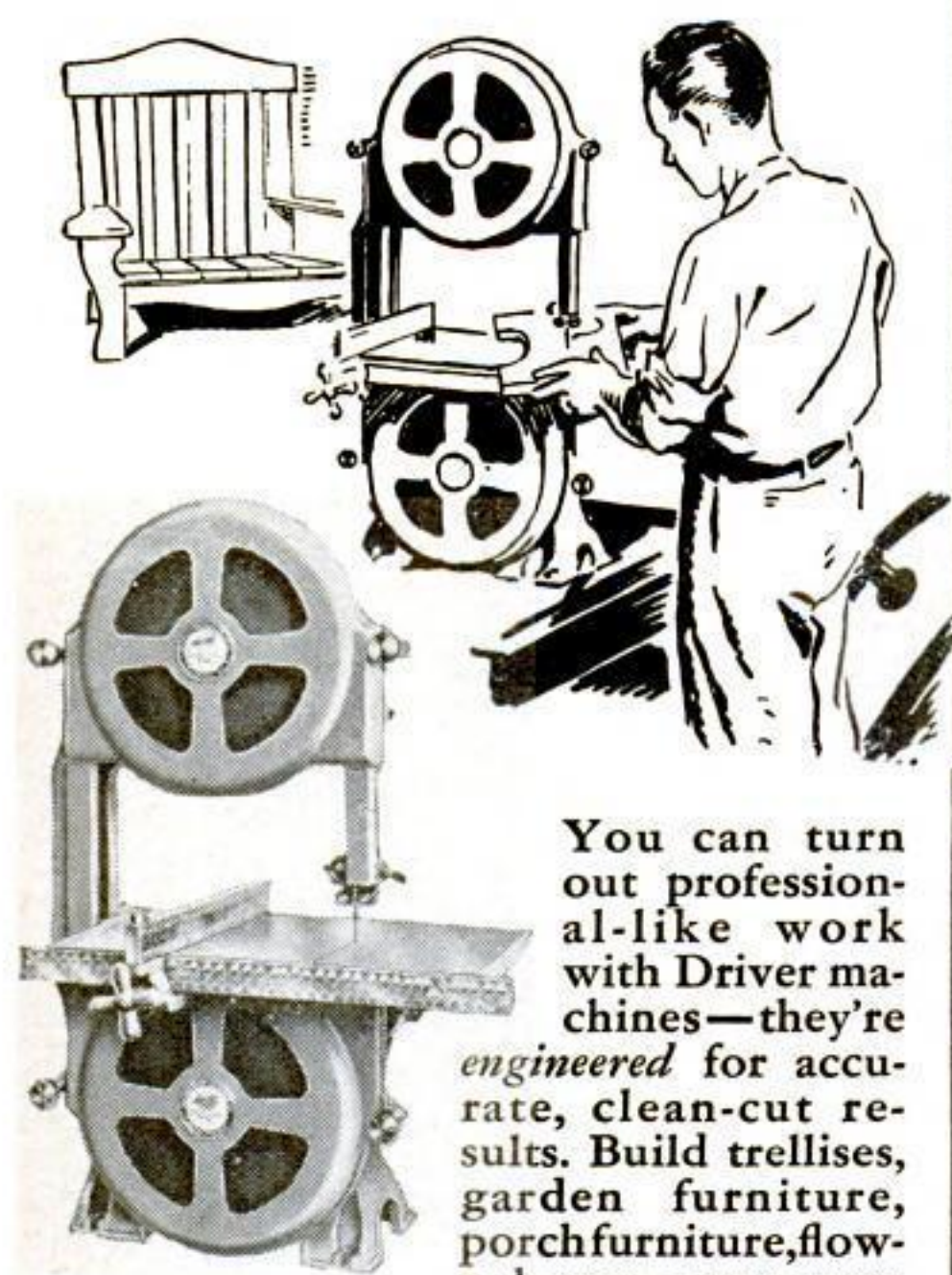
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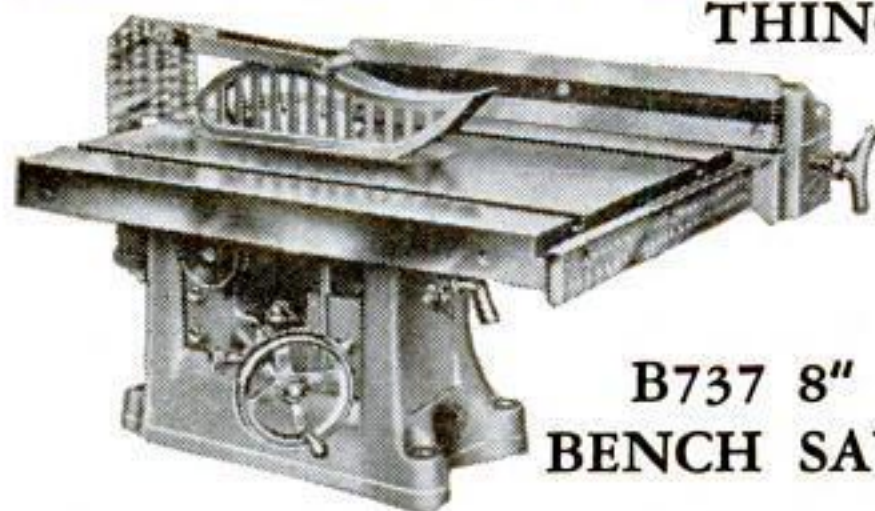
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## Jungles Underfoot

(Continued from page 47)



Face of a monarch butterfly. Note the compound eyes covering most of the head, and the curled proboscis used for sucking nectar

crops at all. So, good and bad, the insects cannot be ignored. They cannot be dismissed as insignificant or unimportant.

To the hobbyist, watching them at work in his ancient Long Island orchard, however, their strange ways, uncanny instincts, and fantastic life histories proved of greater attraction than their economic importance.

In the course of his explorations in this living land of Lilliput, he learned how ants guard and milk their aphids "cattle." He noted how garden spiders wear "boots" of oil to keep them from becoming entangled in the sticky threads of their webs. He discovered that katydids rasp their wings together between 30,000,000 and 50,000,000 times in the course of a single summer. He found that bumblebees sit on their eggs like brooding hens.

ONE of the strangest of all the creatures he encountered is the tiny aphid, or plant louse. This green midget is so small that it would take sixty to equal the weight of one grain of wheat. Yet, these insects multiply so fast that, if all natural checks were removed, the descendants of a single aphid would weigh, at the end of one season, more than all the humans inhabiting the globe!

By "banding" butterflies with markings of aniline dye, he was able to recognize individual insects and trace their movements on successive days. Some returned to the same flowers regularly for weeks at a time; others came once and never visited the spot again.

Among the most curious of the occur-

rences he observed were the butterfly battles. To the average person, these gaily colored creatures appear both frail and peaceful. The idea of butterflies fighting seems as remote as the idea of flowers locked in deadly combat. However, he found that the males of many species often engage in desperate aerial duels, dashing at each other as though bent on destruction, and sometimes battering their wings until they are in shreds. One scientist even reports a believe-it-or-not instance in which a tiny American Copper, hardly an inch long, darted at a bulldog and put it to flight.

AT THE same time that Teale was making notes of the curious things he saw, he was striving to record on film the characteristic attitudes and actions of the creatures he encountered. For this work, he uses a compact 3 1/4 by 4 1/4-inch plate camera with a double-extension bellows. The latter feature permits him to take close-ups which are virtually life-size.

In making pictures of insect faces, highly magnified, he employs the same camera but replaces the regular lens with one having a focal length of only one inch. When this is used with the bellows racked out to the limit, the image on the ground-glass screen is almost a dozen times life-size. Still greater magnification is obtained in enlarging the picture on bromide paper. The result is a photomicrograph produced without the aid of a microscope, a clear picture showing every line and hair magnified many times.

ON SEVERAL occasions, while focusing these magnified pictures, he has had curious surprises. Once, for example, he was peering at the ground glass, watching the image of a tiny leaf hopper come into sharp focus, when he saw an even tinier parasitic insect clamber over the ridge of its back like a mountain goat on a crag. Another time, minute markings on the head of a fritillary butterfly expanded to assume the appearance of a human profile.

During the taking of the picture, the camera is almost always stopped down to at least F/22. This is done to get the greatest possible depth of focus, or distance between the nearest and farthest part of the picture in perfect focus. Because of the closeness of the subject to the lens in this type of work, the depth of focus is shallow, and "fuzzy" photographs result if the lens is used wide open.

All of Teale's pictures are made of living insects. To get his subjects when they are least active, he makes a practice of photographing night-flying moths at midday and day-flying butterflies at night. Sometimes, to quiet a restive insect, he will place it in the refrigerator for a few minutes or give it a

(Continued on page 127)



## Finding Adventure in Jungles Underfoot

(Continued from page 126)

sniff of ammonia fumes. This usually makes it hold still for the short time required for recording its picture on film.

Once, he tried a dozen different ideas for getting bees to stick out their tongues, in an attempt to record the difference in tongue-length between honeybees and bumblebees. Finally, he let the subjects inhale ammonia fumes for a few seconds. Out popped their tongues, and out they remained until the desired pictures were snapped to the photographer's satisfaction.

IN MANY cases, he told me, he gets his shots simply by wearing out the insects, putting them where he wants them over and over again until they hold still. The record for stubbornness is held by a black ant. He had to place it on a leaf about fifty times before it gave in and remained still long enough for a fifth-of-a-second exposure.

When the weather is too windy or the sky too dark for outdoor photography, Teale brings his hobby indoors with him. Using plants with which the insects are usually associated, he produces little "sets" on a table top, or places the creatures in natural surroundings within plate-glass tanks. With the aid of either photoflood or photo-flash bulbs, he records pictures of the insects while they are in the midst of interesting, story-telling actions.

In this manner, he has obtained several of his most striking sequences. One shows the mysterious cannibal feast which ends the mating season of the praying mantis; another the gradually unfolding wings of a great tan-and-opal Polyphemus moth which measured, from wing tip to wing tip, nearly half a foot.

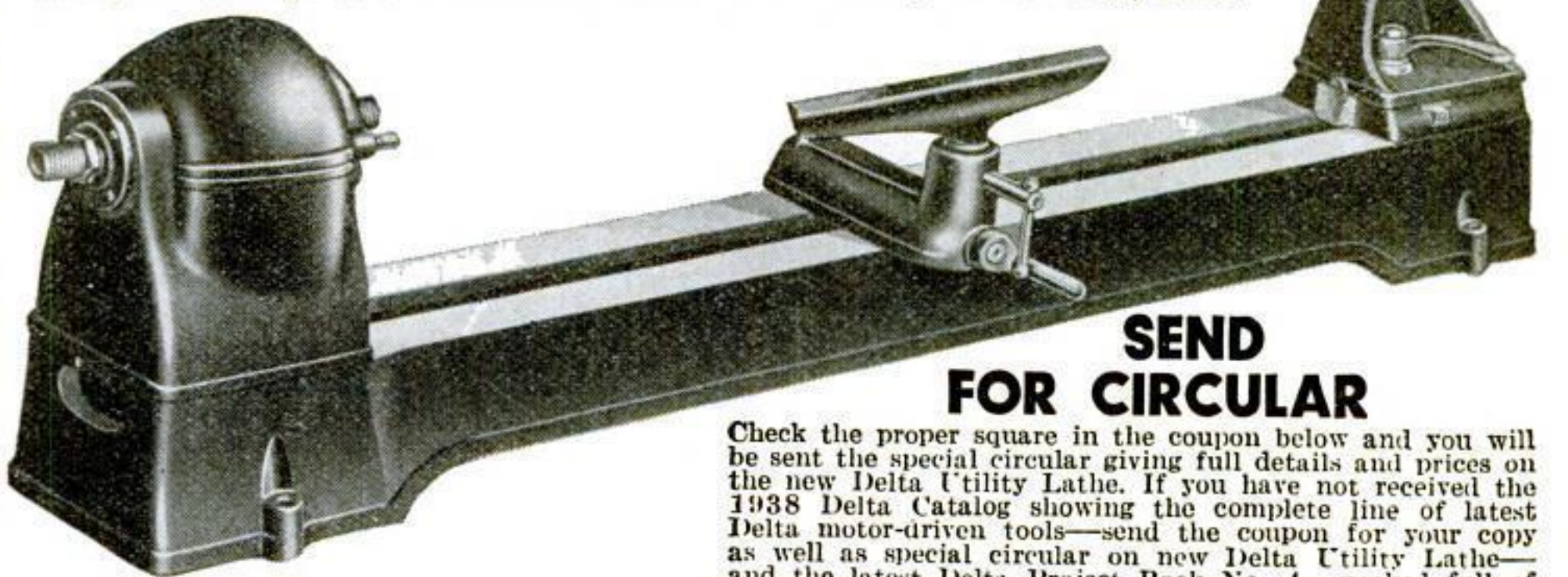
As a result of this spare-time hobby, the home explorer has accumulated a mass of unique pictures, odd facts and unusual experiences out of which his book has grown. Through his observations and photographs, he has enabled others to share his adventures on a safari through the grassroot jungles and to visualize the varied and amazing activity of man's many insect friends and foes.

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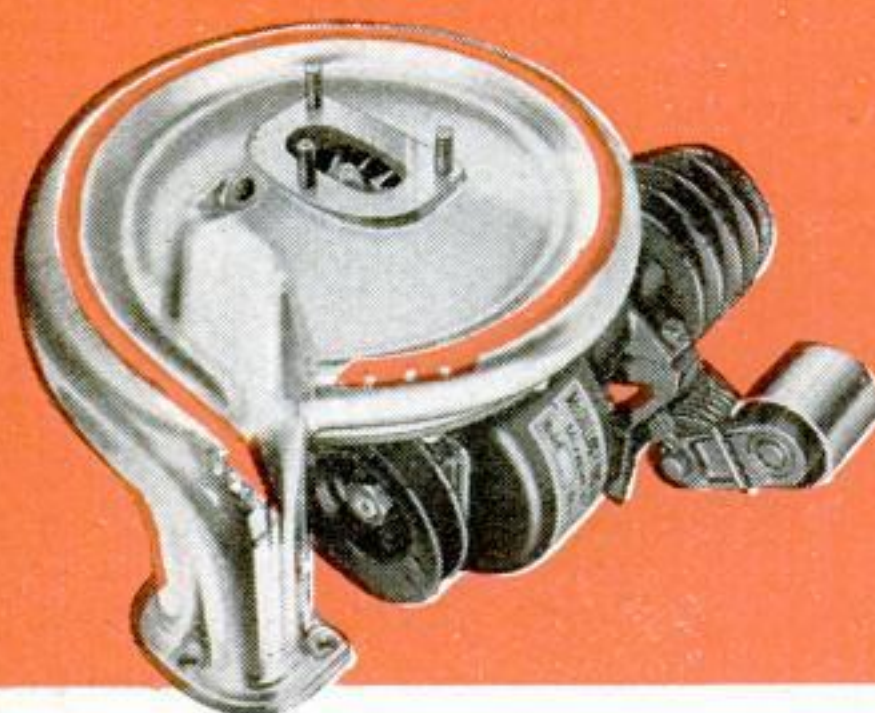
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## Gus Wilson Judges a Contest

(Continued from page 68)

the trouble?” asked Joe impatiently. “You’d never guess,” replied Gus, holding the letter up for Joe to see.

“The trouble went on for several days,” he writes, “so finally my brother-in-law and I decided to strip the motor and examine each part carefully. After we had removed the ignition system and the carburetor, we went to work on the intake manifold. As I leaned down to check the intake holes in the side of the motor, I squinted into the first intake port and what do you suppose I saw? A large mud-dauber’s nest was completely plugging the hole. Evidently, when I had the motor down for the overhaul, the darned wasp decided it was a swell site and went to work building its nest. Naturally, it cut down the intake and choked the motor.”

“WELL I’ll be darned,” grinned Joe. “Next thing you know, we’ll be hearing that a car won’t run because trees are growing out of the exhaust.”

“And that’s not so far-fetched, either,” put in Gus. “I got a letter from another fellow whose car wouldn’t run, and he found twenty-five acorns in his intake manifold. He hadn’t been using his car for a few weeks, and some cagey mouse must have laid up a store there.

“Then there’s a fellow down south who blamed a cat for his most mysterious car trouble. He was riding along one night when he heard a racket that sounded mighty like the yowl of a cat. He stopped the car and raised the hood. There was no sign of a cat, but a tiny puff of steam came from the front of the motor. It turned out that the water-pump bearing had run dry and was so blamed hot that it boiled the few drops of water that leaked out now and then. The steam would get trapped between the packing and the packing nut, and when enough pressure would build up she’d hiss out with a terrific yowl.”

“HOW many letters did you get?” asked Joe.

“Haven’t counted them yet,” said Gus, lighting his pipe, “But there are answers from all sorts of people: doctors, lawyers, housewives, school principals,—”

“Get any from rival garage mechanics?” interrupted Joe.

“Yeah,” nodded Gus. “And by the way, speaking of garage people, what’s the idea of you sending in an answer?”

“Me?” sputtered Joe.

“Yes, you,” grinned Gus, with a twinkle in his eye. “Take a look at this.”

Joe Clark leaned down to read the letter Gus held in his hands. At the top of the page, neatly penned in unfamiliar handwriting was a name and address:

Joe Clark,  
(Joseph M. Clark),  
Staten Island, N. Y.

“Looks as though you’ve got a namesake who reads POPULAR SCIENCE MONTHLY,” said Gus, with a chuckle, as he tossed the letter back on the heap.

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## How to Have Fun With Magnetic Chemicals

(Continued from page 97)

dissolve in their own water of crystallization, the moisture that actually forms a part of their crystalline structure. Suspend a piece of thread about a foot long, and place a drop of the ferric chloride solution in a quarter-inch loop at the bottom end of the thread. The hanging drop will be attracted whenever you bring a magnet near it.

IF YOU do not already have the ferric chloride for this experiment, you can make it yourself. Place about ten cubic centimeters of hydrochloric or sulphuric acid in a beaker and add small bits of iron to the liquid. Keep the beaker warm, and continue to add iron, until no more bubbles of gas arise. Filter the resulting solution, and dilute it with water to a volume of about 200 cubic centimeters (about seven fluid ounces). Then add ammonium hydroxide, a little at a time. This will produce a brown precipitate of ferric (iron) hydroxide. When no more precipitate is formed, you have used enough ammonium hydroxide. Wash the precipitate by decantation—that is, by pouring off most of the liquid above it, refilling with pure water, shaking, and letting the precipitate settle to the bottom. Repeat this several times. Next, filter the solution to recover the brown precipitate. It will take some time for the slimy ferric hydroxide on the filter paper to be freed of the liquid. Finally, dissolve the precipitate in the least possible amount of hydrochloric acid, gently heating the liquid meanwhile. The result will be a strong solution of ferric chloride, suitable for use in the magnetic experiment.

EVIDENTLY, many more substances are magnetic than you imagined when you experimented with your toy magnet. Besides the ones you have just produced, chemicals possessing magnetic properties include a sulphide and an oxide of iron—the latter an ore known as magnetite or more popularly as lodestone. Magnetic metals of the Heusler-alloy type may be made from various combinations of metals, such as one containing sixty-one parts of copper, twenty-five parts of manganese, and fourteen parts of aluminum. Pure oxygen, surprisingly enough, turns out to be magnetic when it is transformed into a liquid at a temperature of nearly 300 degrees F. below zero. Experimenters have placed a small cupful of liquefied oxygen beneath the poles of a powerful electro-magnet, turned on the current, and seen the fluid climb right out of the cup and onto the pole pieces, where it remains stuck until the comparative warmth of the surrounding air boils it away!

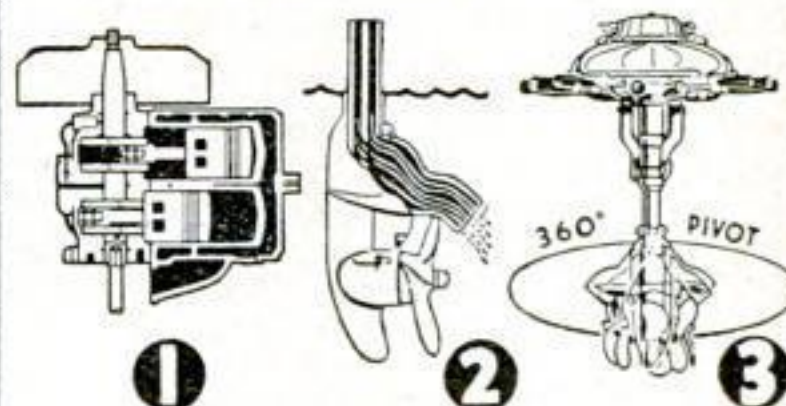
Using only two dry cells and a few drug-store chemicals, you can perform a pretty electrochemical experiment of a different sort. First warm about half

(Continued on page 130)



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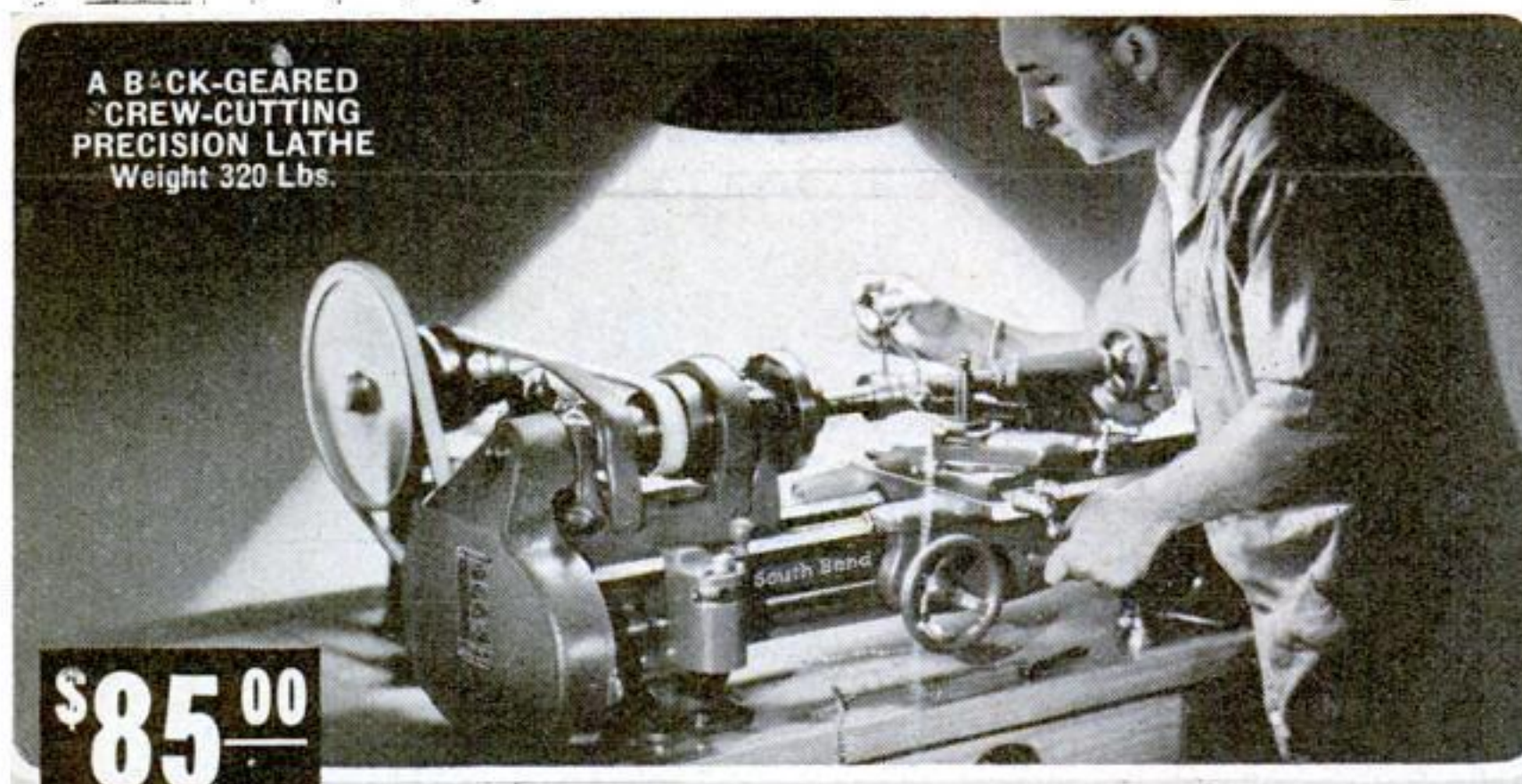


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## How to Have Fun With Magnetic Chemicals

(Continued from page 129)

a gram of starch, or a piece as large as a pea, in 200 cubic centimeters of water. Add about five grams of potassium iodide crystals, and several drops of alcoholic phenolphthalein solution.

**P**LACE this liquid in a glass U tube of, say, half-inch diameter and six to ten inches high. Thrust a wad of absorbent cotton into each limb of the tube, so that the two wads will finally be near its bottom and about three inches apart. Remove the carbon rods from a couple of old flash-light cells, connect them to your pair of dry cells, and place one rod in each limb of the tube for electrodes.

For a short time after the electric current begins to flow through it, the liquid in the tube remains colorless. Soon, however, the solution surrounding the negative carbon turns red, while the fluid around the positive carbon turns blue. The result is a striking red, white, and blue display, mystifying to the onlooker who is not in on the secret.

What actually happens is that the electric current breaks up the dissolved potassium iodide into ions, or charged particles of potassium and iodine. The potassium ions are attracted to the negative carbon, where they react with the water to form potassium hydroxide. In the presence of this alkali, the phenolphthalein solution turns red. Meanwhile the iodine ions are attracted to the positive carbon, where they form ordinary iodine. As in tests for iodine or starch, the mixture of these two chemicals at the positive carbon gives a blue color. The cotton plugs near the bottom of the U tube prevent the colored solutions from diffusing into the lower, colorless fluid as the experiment proceeds.

## POPULAR SCIENCE Question Bee

CHECK up your score in the Question Bee on page 63. In the list below, the letter alongside each number indicates the correct answer to the corresponding question. Give yourself four points for each one you had right. A total of 80 to 92 is good; 92 to 100 is excellent.

### QUESTIONS

- |      |       |       |       |       |
|------|-------|-------|-------|-------|
| 1. c | 6. c  | 11. b | 16. b | 21. c |
| 2. c | 7. b  | 12. d | 17. d | 22. c |
| 3. c | 8. c  | 13. c | 18. c | 23. b |
| 4. e | 9. c  | 14. c | 19. b | 24. d |
| 5. e | 10. a | 15. b | 20. c | 25. a |

### PICTURES

- |                    |                    |
|--------------------|--------------------|
| 1. Scotch yoke     | 6. cam             |
| 2. rack and pinion | 7. eccentric       |
| 3. bevel gears     | 8. ratchet wheel   |
| 4. worm drive      | 9. universal joint |
| 5. bell crank      | 10. Geneva wheel   |

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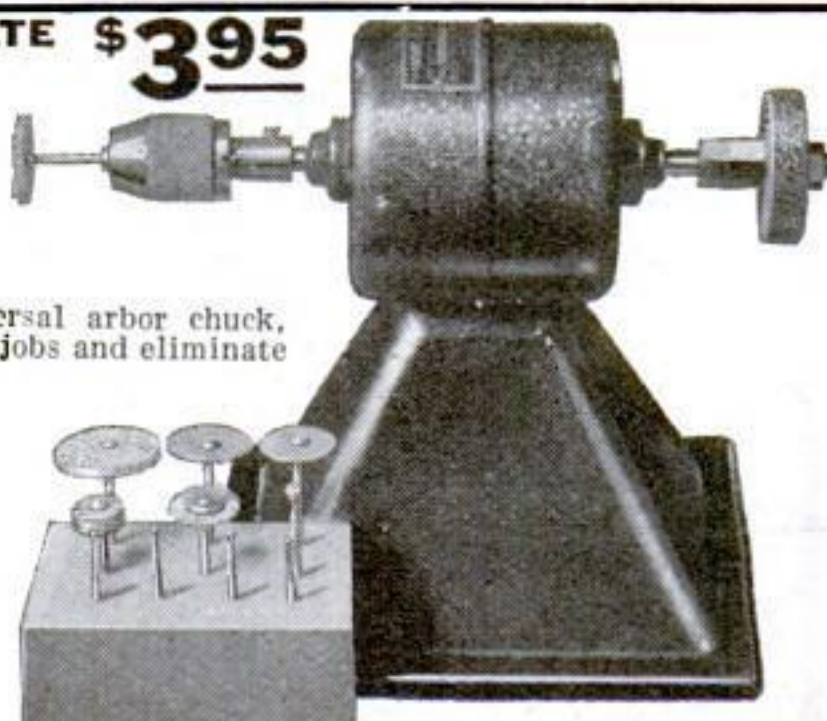
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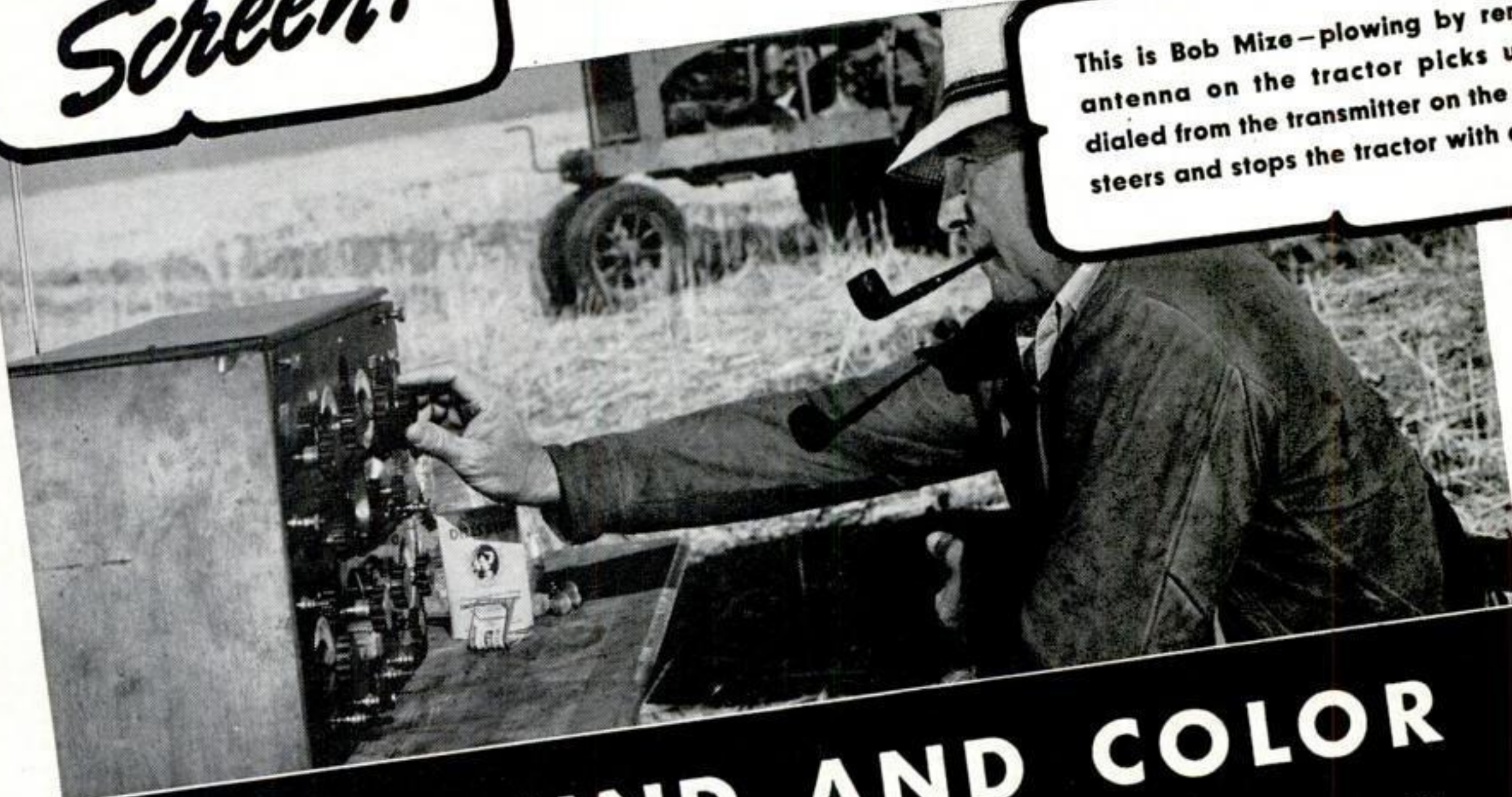


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